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NUCLEAR SCIENCE ABSTRACTS

August 15, 1958

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Volume 12 Number 15
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NUCLEAR SCIENCE ABSTRACTS

A Publication of the United States Atomic Energy Commission Technical Information Service.

SCOPE

Nuclear Science Abstracts (NSA) is intended to serve scientists and engineers working in the field of atomic energy by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only unclassified and declassified research reports of the U. S. Atomic Energy Commission and its contractors, but also material that appears in research reports of other U. S. and foreign government agencies, universities, and industrial research organizations and in the technical and scientific journals.

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Other current data on radioactivity, nuclear energy levels, reactions, moments, etc., were also supplied by that group on 3×5 inch cards on an annual subscription basis. Beginning in January 1958 the Nuclear Data Group began issuing $8\frac{1}{2} \times 11$ inch Nuclear Data Sheets which replace the cards and also incorporate the table "Radioactivity, Levels, Abundances, Moments," which has comprised the greater portion of the New Nuclear Data issues of *Nuclear Science Abstracts*. For this reason the quarterly issues of New Nuclear Data have been discontinued. The 1958 cumulation of New Nuclear Data consisting of tables previously listed in the quarterly issues, and possibly additional tables, will appear as issue 24B of *Nuclear Science Abstracts* Vol. 12.

The Nuclear Data Sheets are available in a light-weight stock for insertion in binders and a heavy-weight stock for drawer filing. Annual subscription prices are $15 for the light and $18 for the heavy stock. Parcel post will be used in the U.S.A., printed matter mail elsewhere. Order from the Publications Office, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, Washington 25, D. C.

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The printing of this publication has been approved by the Director of the Bureau of the Budget, July 30, 1957.

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ERRATA

NSA Vol. 12, No. 4, p. 333. In abstract 2933, E. R. Ripperger should be E. A. Ripperger.

NSA Vol. 12, No. 4, p. 340. In abstract 2996, L. I. Sarycheva should be L. I. Saritcheva.

NSA Vol. 12, No. 7, p. 538. In abstract 4770, UCRL-4937 should be UCRL-4957.

NSA Vol. 12, No. 8, p. 651. In abstract 5754, B. S. Djelepov should be B. S. Dzhelepov.

NSA Vol. 12, No. 8, p. 601. In abstract 5312, J. Am. Chem. Soc. should be J. Am. Ceram. Soc.

NSA Vol. 12, No. 12, p. 937. In abstract 8224, AFOSR-TR-58-51 should be AFOSR-TR-58-41.

NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 15 August 15, 1958

GENERAL

9564 TID-4000(3rd Ed.)
Technical Information Service Extension, AEC.
AVAILABILITY LIST OF USAEC REPORTS. June 1958. 467p. $3.00(OTS).

A list is presented of Atomic Energy Commission reports that have been abstracted in Nuclear Science Abstracts (NSA), Volumes 1 through 11, and in the two volumes of its predecessor, Abstracts of Declassified Documents (ADD). The best known available source for each report is given, including references for those reports which have appeared in the journal literature. A list is included of non-AEC reports that have appeared in these abstract journals (NSA and ADD). No special effort has been made to determine availability of non-AEC items, but such information is given when known. Added information in this edition includes many cross references from primary and secondary report numbers, references to full versions of reports from deleted or condensed versions, and prices as of the date of this publication. (C.H.)

Atomic Bombs and Warfare

9565 WT-1164
Federal Civil Defense Administration, Battle Creek, Mich.
CIVIL DEFENSE MONITORING TECHNIQUES. Fred R. Rehm, Carl A. Cinnamon, and Roscoe H. Goeke. Aug. 1956. 26p. Project 38.1 [of] OPERATION TEAPOT. $1.00(OTS).

Operations were conducted to obtain information by aerial, automotive, and ground monitoring surveys for the purpose of evaluating and correlating the data and methods. Studies were made to determine the attenuation factors of automobiles and airplanes and the time-lag factors of various instruments used in civil defense for the detection of radiation contamination. The results of the aerial survey were evaluated, and correlation factors were developed which permit the interpolation of aerial readings as ground-level radiation intensities within a range of ±50 per cent. Surveys conducted by automobile permitted the development of a set of correlation factors which can be used to compute dose-in-air readings for rapid automotive surveys. Radiation attenuation factors were developed for various aircraft and automotive vehicles. Time-lag factors were also developed for some of the civil defense instruments. The feasibility and practicability of automotive and aerial survey as a radiological monitoring tool were established. The practicability of the use of the SU-10A which has been used for civil defense purposes as an interim aerial survey instrument, was established. The development of an instrument having more suitability for aerial monitoring than present civil defense instruments is encouraged. Likewise, further aerial survey operational studies are recommended for any future continental test series. (auth)

Atomic Power

9566
ATOMIC ENERGY UTILIZATION. AN INTRODUCTION TO THE TECHNICAL, MEDICAL, AND BIOLOGICAL PROBLEMS OF THE ATOMIC AGE. Niels Arley and Helge Skov. Copenhagen, Scandinavian University Books, 1957. 99p. (In Danish)

The engineering problems of atomic energy utilization and the biological dangers of ionizing radiation and atomic energy are discussed. In the area of engineering problems a survey of nuclear physics, neutron physics, reactor physics, health physics, radioactive fall-out, shielding problems, and use of radioisotopes is given. In the area of biological dangers the radiobiological physical fundamentals, effects of ionizing radiation on man, radiation dangers for the general population, comparative radio uptake of plant and animal organism, and progress in radiobiology are discussed. (J.S.R.)

BIOLOGY AND MEDICINE

9567 USNRDL-TR-216
Naval Radiological Defense Lab., San Francisco.
RELATIVE TIME OF ECLOSION OF DROSOPHILA FEMALES HETEROZYGOUS FOR SEX-LINKED RECESSIVE LETHALS. A. F. Yanders. Mar. 31, 1958. 15p.

Male Drosophila melanogaster (Oregon-R) were irradiated with 3200 r of 1.6 Mev electrons and mated to Muller-5 females. The eclosing F_1 female progeny were collected at 12-hour intervals and tested for the presence of sex-linked recessive lethal mutations in the irradiated X-chromosome. The probability that an emerging female possessed a lethal X-chromosome was found to increase significantly in each successive period of collection. Assuming a linear response, a weighted linear regression analysis of the data leads to the equation $\hat{Y} = 5.342 + 1.338\ X$, where $\hat{Y}$ is the expected percentage of lethals and X is the sequential collection

period. These results suggest that newly-induced recessive lethals prolong development in heterozygotes, and that at least part of the viability impairment of heterozygous lethals is a reflection of decreased developmental rate. (auth)

9568

A METHOD OF STUDYING THE CONSTITUENTS OF THE PERIPHERAL BLOOD DURING IRRADIATION. V. E. Busygin and Yu. G. Grigor'ev. Med. Radiol. 3, No. 1, 22-6(1958) Jan.-Feb. (In Russian)

A new method and apparatus are offered for taking blood at a distance during irradiation. (tr-auth)

9569

BONE DENSITY STUDIES WITH A GAMMA GAGE. J. Gershon-Cohen, Norman H. Cherry, and Manfred Boehnke (Albert Einstein Medical Center, Philadelphia). Radiation Research 8, 509-15(1958) June.

A gamma-gage technique was used successfully for the determination of bone density. In addition, this type of gage, with its great sensitivity, should be applicable to many other tissue-density problems in human subjects. (auth)

Radiation Effects

9570 AF-SAM-58-51

Texas. Univ., Austin. Radiobiological Lab.

LETHALITY IN THE RAT AS A FUNCTION OF DOSE PATTERN. Quentin L. Hartwig, Geroge S. Melville, Jr., and Thomas P. Leffingwell. Nov. 18, 1957. 3p.

Rats exposed 7 days to a chronic field of 2 r/hour of Co^{60} gamma rays immediately prior to or immediately after an acute dose of 800 r of Co^{60} gamma rays failed to exhibit a significant difference in either a 30-day or 90-day mortality. When compared to a group of rats receiving only an acute dose of 800 r of Co^{60} gamma rays, both acute-chronic groups evidenced different mortalities; however, these differences were not statistically significant. (auth)

9571 AF-SAM-58-72

Oak Ridge National Lab., Tenn.; and School of Aviation Medicine, Randolph AFB, Tex.

THE RELATIVE BIOLOGIC EFFECTIVENESS OF X-RAYS, GAMMA RAYS, AND FAST NEUTRONS IN THE PRODUCTION OF WEIGHT LOSS OF THE SMALL INTESTINE OF THE MOUSE. M. A. Patetta-Queirolo, M. L. Randolph, and J. A. Sproul, Jr. Jan. 17, 1958. 6p.

Groups of 10-week-old female RF mice were exposed to graded doses of CO^{60} gamma rays, 250-kvp x rays, or 14-Mev fast neutrons. The weight of the small intestine decreased during the first 48 hours after irradiation as a linear function of dose over the range 50 to 700 rads. No significant differences between radiations in the production of this effect were observed 1 day after irradiation, but at 2 days the RBE was found to increase with LET, being 1.0, 1.5, and 2.0 for gamma rays, x rays, and neutrons, respectively. The RBE of neutrons for intestinal weight loss was appreciably higher than for 30-day lethality, in keeping with the hypothesis that the earlier mortality of mice exposed to neutrons, as opposed to x rays, results from relatively greater injury of the gastrointestinal tract by neutrons. (auth)

9572 AMRL-339 (Rpt: UNCLASSIFIED)

Army Medical Research Lab., Fort Knox, Ky.

MASSIVE DOSE IRRADIATION OF THE MAMMALIAN CENTRAL NERVOUS SYSTEM. Jack M. Ginsburg and David D. Ulmer. May 29, 1958. 19p. Project No. 6-59-08-014.

Five thousand roentgen of cobalt-60 gamma rays delivered to the canine head caused a decrease in the cerebral cortex potassium content. Irradiated animals failed to show significant differences in sodium, chloride, and water content of the brain and in the dextrose, gases, and electrolyte content of blood entering and leaving the brain when compared to a control group of sham-irradiated dogs. (auth)

9573 HW-54938

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES QUARTERLY PROGRESS REPORT [FOR] OCTOBER–DECEMBER 1957. J. W. Healy, ed. Feb. 12, 1958. Decl. May 12, 1958. 43p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

Progress is reported in the following studies: the effects of reactor effluent on aquatic organisms inhabiting the Columbia River; the effect of small daily doses of I^{131} on developing swine fetuses; the effect of dietary calcium levels on the uptake of Sr^{90} by lambs; the distribution of intravenously injected Zr^{65} in rats and cattle; the effects of treatment with diethylenetriamine pentaacetic acid on the bone absorption of plutonium in experimental animals; fission product metabolism in plants and animals; the effects of whole-body irradiation on gastrointestinal function in rats; the pathological effects of irradiated intestinal homogenates when injected intraperitoneally into normal rats; the distribution of inhaled or intratracheally adminstered particles of $Ru^{106}O_2$, $Pu^{239}O_2$, and $Sr^{90}SO_4$ in mice and dogs; the demonstration of malignant lung tumors in mice following the intratracheal administration of $Pu^{239}O_2$; the diffusion and transport of stack gases at distances up to eight miles from continuous ground sources; modifications in design and performance checks of radiation detection instruments for monitoring and dosimetry; the development of chemical dosimeters; and studies on ground waste disposal, the gelling of liquid wastes, and the flow of ground waters in the area. (For preceding period see HW-52866.) (C.H.)

9574 USNRDL-TR-219

Naval Radiological Defense Lab., San Francisco.

EFFECTS OF WHOLE BODY X-RADIATION ON THE ACCRETION AND EXCHANGE OF RADIOSTRONTIUM IN THE SKELETON OF DOGS. W. L. Milne, J. S. Arnold, J. K. Gong, and S. H. Cohn. Apr. 8, 1958. 19p.

An attempt was made to quantitate the effects of whole body x irradiation on the inorganic metabolism of the skeletal tissue of adult dogs. A radioisotopic tracer technique employing strontium-85 was used to differentiate in vivo between the amount of exchangeable calcium and the rate of skeletal accretion (Sr^{85} incorporated into the non-exchangeable fraction) in both normal and irradiated beagles. The accretion rate was found to be inversely correlated with the age of the animals. At 10 months following exposure to 300 r (mid-line dose) whole body x irradiation, both the accretion rate and the amount of exchangeable calcium in the skeleton of the irradiated dogs were higher than in the non-irradiated controls. The results are interpreted as indicating that unlike aging the late effect of x irradiation is a stimulation of new bone formation and skeletal metabolism. At 10 days following 180 r, no change in accretion rate was observed, however, there was a decrease in the exchangeable calcium. The latter result is interpreted as

indicating that x irradiation acutely produces a depletion of the labile skeletal calcium reserves which are measurable as exchangeable calcium. (auth)

9575 USNRDL-TR-227

Naval Radiological Defense Lab., San Francisco.
THE ROLE OF BILE SECRETION IN THE GASTROINTESTINAL RADIATION SYNDROME. K. L. Jackson and C. Entenman. Apr. 29, 1958. 27p.

The role of bile secretion in the gastrointestinal radiation syndrome of 1500 r x-irradiated rats was studied. Ligation of the bile duct immediately before irradiation increased the mean survival time from 3.3 days to 5.0 days. Bile duct ligation one day after irradiation reduced the excessive sodium loss, which occurs on the third day after irradiation. Potassium excretion was not altered by this treatment. During the third post-irradiation day the volume of bile secreted by irradiated rats with bile fistulae was 9.8 ± 0.5 ml containing 1.53 ± 0.08 mEq of sodium. Thus, the amount of sodium secreted in bile is sufficient to account for the reduction in sodium loss brought about by bile duct ligation on the basis of the prevention of bile sodium from reaching the intestinal tract. It is concluded that following x irradiation of the rat with 1500 r loss of body sodium due to leakage of this electrolyte directly across the intestinal wall is of minor importance, the major portion of the body sodium loss is the result of an inadequate absorption of bile sodium, which is secreted into the intestine at a normal rate, and the loss of sodium via the bile is an important factor in the cause of death. The possible role of bile secretion in the gastrointestinal radiation syndrome of other mammalian species is discussed. (auth)

9576 AEC-tr-3194

A GENETIC EFFECT IN NATURE FROM THE RADIOACTIVITY IN URANIUM DEPOSITS ? (Eine Gen-Beeinflussung in der Natur als Folge der Radioaktivität von Uranlagerstätten?) Otto Kraus. Translated from Natur u. Volk 87, 399-401(1957). 3p.

Specimens of the myriapod Digitipes katangensis were collected from the sub-soil in the region of the Jadatville uranium deposits of Katanga, Belgian Congo. Abnormalities were observed which may have been induced by the natural radioactivity of the soil in which they had existed for many generations. (C.H.)

9577

X IRRADIATION AND SUCCINODEHYDROGENASE. A. de Schryver. Arch. intern. physiol. biochim. 64, No. 4, 587-93(1956). (In French)

A dose of 750 r of whole-body x irradiation in the rat causes in the liver a decrease of the succinodehydrogenase activity, which reaches 37% on the fifth day. This depression is in large part suppressed by the protection of the animal with a dose of cysteamine. Immediately after irradiation one observes no modification of the enzymatic activity. In vitro the succinodehydrogenase is very radioresistant. A dose of 100,000 r, however, inhibits it 33%. Cysteamine added at the ratio of 1 mg per 150 mg of tissue in the culture before its irradiation protects the enzymatic activity. (tr-auth)

9578

A CONTRIBUTION TO THE QUESTION OF THE EFFECT OF RADIOACTIVE RADIATIONS ON PLANT GROWTH AND YIELD. O. Machold and H. Marschner (Universität Jena, Germany). Atompraxis 4, 128-34(1958). (In German)

The stimulating effect of small doses of P^{32} and Ca^{45} as well as the effect of radioactively labelled superphosphate on plant growth was examined in vitro on oats and summer barley. A 24-hour soaking of oat grains in a radioactive solution of NaH_2PO_4 and $Ca(NO_3)_2$ with activities of 55 and 71 μc Ca^{45} and P^{32}/l, respectively, did not produce a verifiable yield increase either in sandstone or limestone soil. Similar results were obtained in experiments with radioactively labelled superphosphate given in quantities of 0.270 and 0.846 g P_2O_5 with a specific activity of 0.4 mc P^{32}/g P_2O_5. In three cases of slight yield increase, the results could not be verified. In one case, after 41 days of growth, differences were found between inactively and radioactively fertilized plants, but these differences had disappeared by the time the plants were ripe. In addition, experiments are described which permit conclusions on the sensitivity of summer barley, maize, and bush beans to higher doses of P^{32}. With summer barley, clear signs of radiation damage appeared with 350 μc P^{32}/25 l and a specific activity of 2 mc P^{32}/g P_2O_5. Experiments in vitro with summer barley in silicic sand revealed that an addition of P^{32} with a specific activity of 6 mc P^{32}/g P_2O_5 caused complete destruction, in the bifoliate stage as well as at the time of sprouting. An increase in the specific activity of P^{32} (3 to 6 mc/g P_2O_5), as well as in total activity per container, caused an increase in the extent of plant damage. The characteristics of this P^{32} damage are growth inhibition of the youngest leaf, chlorophyll defects (marbling), and increased side-sprouting. Maize showed radiation damage at 2 mc P^{32}/g P_2O_5 in experiments in vitro with silicic sand. On the other hand, bush beans showed no external changes even at 4 mc P^{32}/g P_2O_5. However, they had a lower yield than the control plants. (auth)

9579

UNSOLVED RADIOBIOLOGICAL PROBLEMS AND COMPARATIVE RADIATION RESEARCH. PART III. E. H. Graul (Philipps-Universität, Marburg, Lahn, Germany). Atompraxis 4, 135-8(1958). (In German)

In Part III of the series the radiobiological foundations of radiation sterilization are considered. In addition, the problem of the influence of the environment on radiobiological and radiochemical primary processes is discussed. Here particular consideration is given to the author's own pertinent research results. The problem of the dependence of radiation yield upon the chemical constitution in radiochemical processes is also given special attention. (auth)

9580

THE CHANGES IN THE OXYGEN INTAKE OF BRAIN TISSUE AFTER X-IRRADIATION. A. D. Snezhko. Biofizika No. 2, 67-78(1957).

X irradiation of various parts of the body of rabbits was found to induce changes in the concentration of oxygen in brain tissue. Changes were observed in blood circulation indicative of suppression of oxidizing activities in the cerebral cortex following exposure to ionizing radiation. (C.H.)

9581

INFLUENCE OF IONIZING RADIATIONS ON THE SORPTION PROPERTIES OF THE TISSUES OF VARIOUS ORGANS IN VIVO. A. M. Kuzin and E. A. Ivanitskaia (Inst. of Biophysics, Academy of Sciences of the U.S.S.R., Moscow). Biophysics (USSR) (English Translation) 2, 311-20(1957).

The sorption capacities of rat tissues were investigated in vivo 2, 24, and 48 hr after x irradiation using P^{32}-labeled colloidal chromic phosphate, I^{131}-labeled iodinated globulin, and Ag^{110}-labeled colloidal silver solution. It is shown that about 70% of the colloid injected was absorbed by the liver. Within 24 to 48 hr

after irradiation the absorptivity of the liver decreased. From 48 to 75 hr the sorption capacity of the liver again increased. It is suggested that this reduction may be due to physico-chemical changes in the macromolecules which form the surfaces, and in the protoplasm of cells in the reticuloendothelial system, and that it is closely linked with changes in antibody synthesis. (C.H.)

9582

ON THE CAUSES OF REGENERATION ABILITY LOSS IN THE AXOLOTL EXTREMITY AFTER X-RAYING. V. F. Sidorova (Lab. of Growth and Development, Inst. of Experimental Biology, Academy of Sciences, USSR, Moscow). Bull. Exptl. Biol. Med. (USSR) (English Translation) 43, 215-19(1957) Feb.

It was demonstrated that the amputation of an irradiated organ does not bring about its regeneration in the case of the denervation of the axolotl extremity x-rayed with the dose of 5000 r. Under the conditions of provisional denervation of the intact extremity followed by irradiation, and amputation after innervation restitution, no regeneration was found. The loss of regeneration ability in the axolotl extremity is, apparently, unconnected with the change of peripheral nerve fibers in the stump. (auth)

9583

β-RADIATION OF THE FETAL FLUID IN MAN. A. I. Danilenko (A. A. Bogomolets Inst. of Physiology, Academy of Sciences of the Ukrainian SSR). Bull. Exptl. Biol. Med. (USSR) (English Translation) 43, 330-2(1957) Mar.

It was experimentally proved that the activity of naturally-occurring β-radiation of the fetal fluid is different depending upon the sex of the embryo. Thus, radiation activity of the fluid in which a fetus of the female sex was developing, was found to be significantly higher than that of the fluid in which a fetus of the male sex was developing. (auth)

9584

THE ROLE OF SULFHYDRYL GROUPS AND PEROXIDE COMPOUNDS IN THE MECHANISM OF THE BIOLOGICAL ACTION OF IONIZING RADIATION. M. B. Gintsburg, E. M. Pandre, and N. M. Binus (Ukrainian Scientific Research for Sanitary Chemistry, Kiev). Biochemistry (USSR) (English Translation) 22, 431-8 (1957) May-June.

Peroxide is formed under the action of x-rays in the excised tissues of irradiated rats, and the reactivity of the sulfhydryl groups contained in the enzyme systems is apparently increased. (auth)

9585

THE SURVIVAL OF PARAMECIUM CAUDATUM IN RELATION TO THEIR NUMBER PER VOLUME-UNIT WHEN EXPOSED TO X RADIATION. E. G. Zinov'ieva (Severtsov Inst. of Animal Morphology). Doklady Akad. Nauk S.S.S.R. 118, 694-7(1958) Feb. 1. (In Russian)

Experiments showed that the resistance of Paramecium caudatum is considerably higher than previously suspected. A dose of 500 kr resulted in practically 100% survival at certain concentrations of the infusoria. Diagrams are presented of the infusoria survival in relation to their concentration at various doses (from 100 to 500 kr), and a nomogram is given for the determination of the infusoria survival in relation to the critical volume of the media per organism and exposure dose. (R.V.J.)

9586

THE EFFECTS OF GAMMA RAYS ON THE RATE OF DYE ACCUMULATION IN LIVING RETICULAR ENDOTHELIAL ELEMENTS. M. S. Konstantinova. Doklady Akad. Nauk S.S.S.R. 118, 698-700(1958) Feb. 1. (In Russian)

The action of gamma rays on the lymphatic ganglion of rabbits has a depressing effect on the reactive absorption properties of the reticulo-endothelium at 800-r dose and a stimulating effect at 100-r dose. (R.V.J.)

9587

EFFECTS OF VITAMIN B_{12} AND FOLIC ACID ON THE THROMBOPLASTIC ACTIVITY DURING EXPERIMENTAL RADIATION DISEASE. V. A. Kudryashov, G. V. Andreenko, and N. P. Sytina (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 118, 701-4(1958) Feb. 1. (In Russian)

Experiments were made to determine the effects of vitamin B_{12} and folic acid on the thromboplastic activity of blood in 300 white rats exposed to 400 to 800 r doses. The exposure to 400 to 650 r doses caused a drastic drop in the blood thromboplastic activity induced by the lack of blood prothrombokinese. Intramuscular injections of vitamin B_{12}, folic acid, or both substances simultaneously did not produce any positive results in the preservation or restoration of blood thromboplastic activity. However, simultaneous intramuscular injection of vitamin B_{12} and folic acid in rats exposed to radiation but protected in the lumbar region by a lead plate resulted in considerable retention of the thromboplastic activity of the blood and speeded up its restoration to the normal physiological level. (R.V.J.)

9588

THE PRIMARY SUTURE OF WOUNDS IN EXPERIMENTAL RADIATION SICKNESS. B. L. Razgovorov. Eksperimental'naya Khirurgiya No. 2, 47-50(1957) Mar.-Apr.

After guinea pigs, rabbits, and dogs were subjected to toxic doses of x radiation, various wounds were inflicted. Data are presented on recovery of the animals. (C.H.)

9589

EFFECT OF IONIZING RADIATION ON THE ACTIVITY OF DIGESTIVE ORGANS IN DOGS. Yu. N. Uspenskiy. Fiziol. Zhur. S.S.S.R. No. 4, 328-35(1957) Apr.

The abdominal regions of six dogs were exposed to 660 r x radiation for 30 min. Five of the dogs died on the 5th, 18th, and 22nd days. The other five were alive after 2 months but in a state of extreme emaciation. Observations were made on digestive processes in the irradiated dogs by means of a Pavlov stomach and surgical fistulas. Disturbances in the secretory activity of the gastric glands fluctuated in all of the dogs. Hunger periodicity showed shorter rest periods and an intensification of hunger contractions. Determinations were made on the protein and protein fraction content of the blood serum and digestive juices. The sharpest changes in hemopoiesis were found to coincide with the most striking disturbances in the function of the digestive organs. (C.H.)

9590

BIOLOGICAL EFFECTS OF IONIZING RADIATION VIEWED IN THE PRESENT LIGHT ON THE NATURE OF DNK. A. M. Kuzin. Izvest. Akad. Nauk S.S.S.R., Ser. Biol. No. 3, 273-84(1957) May-June.

Examination of data from a study of radioinduced changes in living organisms led to the conclusion that the predominant effect of ionizing radiation is on high polymeric nucleoproteins and nucleic acids. Disturbances in the structure of the nucleic acids are reflected in the synthesis of specific albumin enzyme systems

which produce in turn a general metabolic disturbance. (C.H.)

9591

IN VITRO SENSITIVITY OF NORMAL HUMAN LYMPHOCYTES TO X-RAYS AND RADIOMIMETIC AGENTS. Robert Schrek (Veterans Administration Hospital, Hines, Ill.). J. Lab. Clin. Med. 51, 904-15(1958) June.

Human lymphocytes from blood and lymph nodes survived satisfactorily in slide chambers with 10% of the cells usually surviving 8 or 9 days. The 10% survival time was reduced to about 2 days by 1,000 r of x rays, 3.0 μg per milliliter of nitrogen mustard, or 0.3 μg per milliliter of triethylene melamine. The slope of the dose-effect curves was greater for nitrogen mustard than for x rays or triethylene melamine. The lymphocytes of the lymph nodes appeared to be twice as sensitive to x rays as those of the blood. A dosage of 2 to 5 r sufficed to produce a perceptible toxic effect on the human lymphocytes. The human lymphocyte, like the rabbit thymocyte, showed two distinct morphologic reactions to x rays. The lymphocyte died by means of delayed fixation after treatment with 4,000 r, and by intranuclear vacuolization, lobulation, and pyknosis after 1,000 r. The two radiomimetic agents tested produced the same two types of death depending upon the dosage of the reagents. (auth)

9592

EFFECTS OF NOVOCAINE ON CERTAIN CHANGES INDUCED BY IONIZING RADIATION IN THE NERVOUS SYSTEM OF ANIMALS. H. N. Livanov and L. I. Kaburneva. Med. Radiol. 3, No. 1, 9-16(1958) Jan.-Feb. (In Russian)

Experiments show an increase of impulses coming to the cortex which is followed by depression of the cortical activity after total irradiation of rabbits with a dose of 1000 r. This depression probably reflects the conditions of the threshold of inhibition. Normalization of the central-peripheral relations was attempted. Novocaine was used as a pharmacological agent blocking the impulses. The minimal doses of novocaine were chosen, which caused the impulses coming into the cortex to drop down almost to the normal value. (tr-auth)

9593

DEPENDENCE OF X RADIATION INDUCED PHYSICAL THERMOREGULATION CHANGES ON THE CONDITION OF THE HYPOTHALAMIC AREA IN RABBITS. I. N. Kondrat'eva. Med. Radiol. 3, No. 1, 16-22(1958) Jan.-Feb. (In Russian)

It is suggested that the hypothalamic area is in parabiotic condition after irradiation. Depression of respiratory reactions in response to warming at the early period following irradiation is probably caused by the inhibition of the spinal centers. They are, as it appears, the most important links in the transfer of excitation on the afferent portion of the arch of the thermoregulating respiratory reflex. (tr-auth)

9594

THE EFFICACY OF REVACCINATION AGAINST TYPHOID FEVER IN IRRADIATED ANIMALS. M. A. Tumanyan and A. V. Izvekova (Gamalei Inst. of Epidemiology and Microbiology). Med. Radiol. 3, No. 1, 26-9 (1958) Jan.-Feb. (In Russian)

It was shown in the previous work that an exposure to x radiation after immunization considerably decreases the immunity of animals to typhoid fever infection. It is now shown that revaccination carried out in 10 days following irradiation causes pronounced immunity in irradiated white mice, which is not less than the immunity of revaccinated animals not subjected to irradiation. Production of immunity in revaccinated animals is due to the changes of immunological reactivity which is preserved in the irradiated organism and appears as a result of primary immunization, carried out before the irradiation. (tr-auth)

9595

BIOLOGICAL EFFECT OF THE CELLULAR STRUCTURES IN NORMAL AND IRRADIATED RABBITS. N. H. Klemparskaya, R. V. Petrov, and L. I. Il'ina. Med. Radiol. 3, No. 1, 34-41(1958) Jan.-Feb. (In Russian)

The study of the fractions of cellular microstructure of the liver and intestinal mucous membrane in normal and irradiated rabbits showed that these fractions are able to produce direct and remote biological effects when introduced to the animal of the same species. Direct effect was manifested in rapid death in presence of leukopenia. Remote results of the biological effect were manifested in the change of reactivity of the organism of recipient to the experimentally induced infection and to the action of ionizing radiation, as well as by reduction of weight, fever, leukocytosis, and death. Preparations which were obtained from irradiated animals were 5 to 7 times more active than those derived from the normal ones. (tr-auth)

9596

MORPHOLOGICAL CHANGES IN THE BONES OF RATS AFFECTED BY RADIOACTIVE YTTRIUM-91. N. N. Litvinov. Med. Radiol. 3, No. 1, 41-50(1958) Jan.-Feb. (In Russian)

About 0.6 microcurie per kilogram of body weight was introduced intraperitoneally to 70 white rats. During the first month the process of osteogenesis was depressed, while the process of bone dissolution and development of osteogenic tissue in the periphery of bone structures was enhanced. In the following 2 to 6 months the process of endochondral ossification was retarded. Later it was observed that endochondral ossification stopped prematurely. The most pronounced changes were revealed in metaphyses of long bones during the first 2 to 6 months. They consisted in progressive disturbance of the processes of osteogenesis with formation of immature fibrous structures and development of osteogenic tissue. Later, the changes of osteogenic tissue brought about the development of malignant growth. Bone tumors appeared in metaphyses of long bones and in the majority of cases were of osteoplastic character. Osteogenic sarcomas developed in 17 rats out of 25 which were sacrificed in 165 days or later after the introduction of the radioactive substance. (tr-auth)

9597

THE EFFECT OF PENETRATING RADIATION ON THE REFLEXES FROM INTESTINAL RECEPTORS. T. K. Dzharakyan and G. F. Fakhrutdinov (Kirov Military Medical Academy, Leningrad). Med. Radiol. 3, No. 2, 11-19(1958) Mar.-Apr. (In Russian)

The reflexes from the chemo-, baro-, and thermoceptors of the small intestine were studied in acute and chronic experiments on dogs after the general action of penetrating radiation (400 r). Regular changes were revealed in the reflexes. They consisted of an increase of the vegetative components (vascular-motor, cardiac, and respiratory) and other components (movement of the head and the body) of the reflex reaction in response to the action of the stimulants of the threshold value, as well as in considerable increase of the consequent period. The changes in the reflexes appear on the 6th to 10th day after the action of penetrating radiation and

increase with development of this disease. The intensity of these changes depend on the gravity of the radiation sickness. In the authors' opinion the changes in the reflexes are due to disturbance of the functional condition of the subcortical ganglia of the central nervous system. (tr-auth)

9598

CHRONAXIE OF THE NEUROMUSCULAR SYSTEM AND DEFENSIVE REFLEXES IN DOGS DUE TO THE EFFECT OF RADIOACTIVE BROMINE. A. I. Ulyanova and V. P. Shmelev (Voronezh Medical Inst.). Med. Radiol. 3, No. 2, 19-22(1958) Mar.-Apr. (In Russian)

Radioactive bromine introduced per os in doses of 0.170 to 0.342 mc 2 to 4 times with the interval of 12 days to 6 months did not cause any visible changes in behavior or condition of the animals either on the day of its administration or later. Chronaxie of unconditioned defensive reflex is prolonged to 135 to 320% of its initial value in the same experiments. Muscle chronaxie is at first shortened by $1\frac{1}{2}$ to $2\frac{1}{2}$ times under the effect of $NaBr^{82}$ but later becomes prolonged. There were no regular changes revealed in the rheobase of the muscle chronaxie and chronaxie of the defensive reflex after the introduction of Br^{82}. Changes in the neuromuscular system appear and disappear on the first day, while the changes in the spinal reflexes remain up to the 57th day. Changes of the spinal reflexes have, evidently, no connection with the changes in the neuromuscular system. (tr-auth)

9599

THE EFFECT OF SINGLE IRRADIATION BY X RAYS ON DEVELOPING BRAIN IN RATS. E. N. Kosmarskaya and Yu. I. Barashnev (Inst. of Pediatrics, Academy of Medical Sciences, USSR). Med. Radiol. 3, No. 2, 23-31 (1958) Mar.-Apr. (In Russian)

The effect of x rays was studied on the development of the brain of white rats in the early postnatal period (from birth to 14 days). This period was chosen because active processes of growth and multiplication of cells and capillaries and formation of various portions of the brain take place in rats during the first 14 to 17 days. After irradiation the disturbance of the growth of the cerebral hemispheres is manifested in decrease of their size, especially of the medial portion of the occipital lobe. The injurious effect of x rays is especially pronounced in the cerebellum. However, there is no disturbance in the growth of corpora quadrigemina. The weight of the rat's brain irradiated on the 1 to 14th day of life is much less than in the control animals. The earlier the irradiation the greater its injurious effect on the brain development (the dose being the same). (tr-auth)

9600

CHANGES IN THE LATENT PERIOD OF THE FLEXOR REFLEX OF THE RABBIT'S SHIN FOLLOWING X-RAY IRRADIATION IN THE DOSE OF 10 r. I. V. Fedorova (Central Research Roentgen-Radiological Inst.). Med. Radiol. 3, No. 2, 32-7(1958) Mar.-Apr. (In Russian)

Small doses of ionizing radiation change the latent period of the flexor reflex of the rabbit's tibia. The author has investigated these changes in the rabbits following single x-ray irradiation in the dose of 10 r. The skin of the tibial region was stimulated by electrode needles with 0.5 to 1.0 v. The reflex time was registered by an electronic milli-stopwatch every 2 hours (5 times daily). This method gave the opportunity to observe the reaction to the total irradiation in small doses. The variations in the time of the reflex in control animals equalled, on the average, 8.5 milliseconds in weak stimulation and 7.6 milliseconds in strong. These variations were more pronounced on the 1st, 3rd, 4th, 6th, 8th, and 11th day after irradiation and showed undulating decrease at the end of this period. From the 13th day these variations were the same as in the control animals. (tr-auth)

9601

THE EFFECT OF IRRADIATION OF THE BODY ON THE VIRULENCE OF TYPHOID FEVER BACILLI. G. A. Chekatilo. Med. Radiol. 3, No. 2, 37-42(1958) Mar.-Apr. (In Russian)

The study was carried out on the pathogenic properties of typhoid fever bacilli from the organism of irradiated (by 100, 200, and 300 r) and non-irradiated (control) guinea pigs. The animals were infected intracutaneously, after irradiation. The pathogenic properties of the microbes, isolated from the cutaneous foci, were examined by intraperitoneal inoculation of white mice with the dose of 15 and 30 million microbes. The total of 156 strains were examined and 762 mice were infected. It was established that the mortality of mice infected with the bacterial cultures isolated from irradiated guinea pigs was higher than in mice infected with cultures isolated from non-irradiated mice (54.5% in the experimental group, as against 38% in the control group). Besides, it was revealed that the longer the microbes remained in the tissues of the macroorganism the greater became their virulence. This property was more pronounced in irradiated animals. Therefore, increase of the microbe virulence in the irradiated organism is connected with the effect of irradiation which acts upon the microbes through the organism. (tr-auth)

9602

CHANGES IN METABOLISM OF NUCLEIC ACIDS IN INTERNAL ORGANS FOLLOWING X-RAY IRRADIATION OF THE BRAIN. E. A. Dikovenko (Central Research Roentgen-Radiological Inst.). Med. Radiol. 3, No. 2, 42-6(1958) Mar.-Apr. (In Russian)

A number of changes are revealed in the nuclear metabolism of the spleen, liver, bone marrow, and the mucous membrane of the small intestine when head alone is irradiated by x rays with screening of the body. In this case the degree and duration of changes in the nuclear metabolism depends on the severity of the developing radiation sickness. The authors consider that there are at least 2 mechanisms in disturbances of the nuclear metabolism under the effect of ionizing radiation, i.e., the direct chemical changes in irradiated tissue and the metabolic disturbances which appear as a result of the change in the neuro-humoral regulation. (tr-auth)

9603

SENSITIVITY OF NEWBORN RATS TO VARIOUS DOSES OF PENETRATING RADIATION. V. V. Kholin (Kirov Leningrad State Inst. for Advanced Medical Studies). Med. Radiol. 3, No. 2, 49-53(1958) Mar.-Apr. (In Russian)

It was established that the course of radiation sickness in the newborn rats had certain specific features as compared with the course in mature rats. The character and the degree of manifestation of these specific features depended on the dose. (tr-auth)

9604

THE EFFECT OF TOTAL X-RAY IRRADIATION ON THE SECRETORY FUNCTION OF THE STOMACH AND INTESTINES. M. F. Nesterin (Inst. of Nutrition, Academy of Medical Sciences, USSR). Med. Radiol. 3, No. 2, 61-6(1958) Mar.-Apr. (In Russian)

The condition of the secretory function of the stomach and intestines in total x-ray irradiation in the dose of 200 r was studied. Experiments on chronically operated dogs with Pavlov's pouch and isolated sections of intestines by Tiery's method were performed. Following irradiation the quantity of stomach juice was increased. This condition of hypersecretion lasted from 12 to 14 days. In analysis of the secretory curve in dogs with Pavlov's pouch, a disturbed relationship of the phases of stomach secretion was noted (following irradiation the relative amount of the juice secreted during the nervous phase decreased while that secreted during the chemical phase increased). The periodic character of the secretion of the intestinal juice was not changed following irradiation. The amount of the intestinal juice was increased in certain dogs. The value of enterokinase and basic phosphatase in 1 g of mucous lumps was increased by 2 to 3 times. This change lasted for about 2 weeks. Excretion of enterokinase and phosphatase with feces was, likewise, increased during the first few days after irradiation. (tr-auth)

9605

THE CHANGE OF PERMEABILITY OF THE VESSELS DUE TO THE LOCAL EFFECT OF IONIZING RADIATION IN LARGE DOSES. V. M. Mastryukova. Med. Radiol. 3, No. 2, 66-71(1958) Mar.-Apr. (In Russian)

It was established that irradiation by x rays in the dose of 4500 r brings about considerable increase of permeability of the skin vessels on the third day after irradiation. On the 11th day after the action of ionizing radiation this permeability is decreased in comparison with the normal. Edema of the tissues which occurs after local irradiation is due not only to disturbed permeability of capillaries, but also to disturbance of the lymph circulation, as well as to certain other factors. (tr-auth)

9606

WHOLE BODY X-IRRADIATION OF EXPERIMENTAL ANIMALS. M. J. Corp (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. in Med. Biol. 1, 370-9(1957) Apr.

The use of conventional x-ray therapy machines for whole-body irradiation of experimental animals is described. It is shown that irradiation from one side only gives what is probably a sufficiently uniform dose distribution in mice. In the case of rats and larger animals non-uniformity of dose distribution due to absorption is considerable although the average dose is seen to be very close to the dose measured in the absence of the animal but at the position its center would occupy. Bilateral techniques are therefore recommended if dose distributions uniform to 5% are desired. There is some evidence that dose distributions may be estimated fairly closely from standard depth dose tables for semi-infinite phantoms. (auth)

9607

THE DOSIMETRY AND LETHAL EFFECTS OF MATERNALLY ADMINISTERED PHOSPHORUS-32 AFTER 14 AND 17 DAYS OF GESTATION IN THE RAT. Melvin R. Sikov and James E. Lofstrom (Wayne State Univ. Coll. of Medicine, Detroit). Phys. in Med. Biol. 2, 157-68(1957) Oct.

Pregnant female albino rats were given graded doses of radiophosphorus after 14 or 17 days of gestation and sacrificed at intervals after injection through birth. One millicurie or less of P-32 did not increase prenatal mortality after administration on either of these two days. Two millicuries produced prenatal deaths when administered after 14 days of gestation but not after 17 days; some deaths attributable to the trauma of parturition were noted in both cases. A depression of the growth curve and of birth weight was produced by doses of 0.4 mc and larger after 14 days and by doses of 0.6 mc and above after 17 days of gestation. The curves of accumulated radiation dose to the whole fetus and to various organs and systems as interpolated to one millicurie are presented and discussed. (auth)

9608

THE BREAKAGE OF TRADESCANTIA CHROMATIDS BY IONIZING RADIATIONS. John Read (Univ. of Otago, Dunedin, New Zealand). Phys. in Med. Biol. 2, 258-70 (1958) Jan.

The theory of the breakage of Tradescantia chromatids by ionizing radiations is discussed with particular regard to the unexpected efficiency of gamma radiation. (auth)

9609

LIPID METABOLISM IN X-IRRADIATED MICE AND RATS. Roy B. Mefferd, Jr., William W. Webster, and Melvin A. Nyman (Univ. of Texas, Austin and Southwest Foundation for Research and Education, San Antonio). Radiation Research 8, 461-5(1958) June.

X-irradiated rats and mice showed significant changes in the specific activities of total nonsaponifiable lipids, cholesterol, and fatty acids. The latter were elevated by day 6, but by day 9 to 15 these had returned to control levels. The specific activities of the cholesterol were less variable, but they were significantly low on day 9 in the mice and day 15 in the rats. Cholesterol and fatty acid metabolism were quite different, and in the latter the metabolism of the solid and liquid fatty acids were quantitatively different. (auth)

9610

ANIMAL PERCEPTION OF X-RAYS. Edward R. Baylor and Frederick E. Smith (Woods Hole Oceanographic Inst., Mass. and Univ. of Michigan, Ann Arbor). Radiation Research 8, 466-74(1958) June.

Daphnia magna, when irradiated by x rays in the presence of red light, swims downward, indicating a preferential stimulation of the nauplius eye. A lack of effect on other behavior patterns indicates that no significant change occurs between the yellow and blue receptors of the compound eye. The structure and function of these two eyes are reviewed. Photographic records of irradiated daphnids indicate that too little fluorescence exists in the organisms to account for the response. Experiments with redox-poisoning compounds, however, reveal that the effect of x rays can be duplicated with reducing compounds. No experiments were performed to test whether or not the x rays had a direct bleaching effect on the visual pigments. Miscellaneous other factors such as heat are eliminated as possible mechanisms. (auth)

9611

RADIATION-INDUCED "DENTAL DEATH" IN MICE. A. C. Upton, R. F. Buffett, J. Furth, and D. G. Doherty (Oak Ridge National Lab., Tenn. and Children's Cancer Research Foundation, Boston). Radiation Research 4, 475-9(1958) June.

Young adult mice developed defects of the incisor teeth after exposure of the head to 1250 to 1800 r of x rays. The time of onset of dental defects varied with the dose of radiation, all mice exposed to 1350 r exhibiting changes within 70 days after exposure. Mice affected severely were unable to feed adequately on food pellets and starved to death unless provided with a soft diet. Intraperitoneal injection of 2-mercaptoethyl-

guanidine • HBr before irradiation lessened the extent of radiation injury of tooth-forming cells. (auth)

9612

EFFECT ON CIRCULATING BLOOD VOLUME OF PARTIAL SHIELDING OF RAT INTESTINE DURING X-IRRADIATION. Marguerite N. Swift and S. Tom Taketa (U. S. Naval Radiological Defense Lab., San Francisco). Radiation Research 8, 516-25(1958) June.

A lethal acute intestinal radiation syndrome was produced in rats by 100 r of x irradiation. All animals were exposed with head and thoracic regions lead-shielded in order to minimize hematopoietic damage. By using the P^{32}-tagged red cell dilution method, circulating blood volume changes were studied in groups of animals that had been exposed with or without additional lead-shielding of a very short segment of ileum, a procedure which decreases intestinal radiation mortality significantly. Total circulating blood volume decreased markedly in both groups after irradiation, but the loss was significantly less severe in rats exposed with the ileal segment shielded. Four days after irradiation, blood volumes averaged 63 and 78% of normal in control irradiated and ileal segment-shielded groups, respectively. Although both groups sustained some loss of red cells, the total blood volume losses measured were mainly due to loss of plasma, presumably reflecting fluid loss by way of the intestinal lumen. Plasma volumes averaged 40 and 66% of normal on the fourth day in control and ileal segment-shielded groups, respectively. Rats surviving the critical period for intestinal radiation deaths showed blood volumes approaching normal levels on the sixth day. With the hematocrit taken as an approximate index of plasma volume change, serial determinations made on individual animals of both groups showed that mortality and survival time were closely related to the degree and rate of plasma loss. (auth)

9613

MODIFICATION OF RADIATION DAMAGE IN DORMANT SEEDS BY STORAGE. H. J. Curtis, N. Delihas, R. S. Caldecott, and C. F. Konzak (Brookhaven National Lab., Upton, N. Y. and Univ. of Minnesota, St. Paul). Radiation Research 8, 526-34(1958) June.

Dormant seeds of barley were exposed to different doses of x rays, γ rays, or fast neutrons and stored for varying times after the treatment. After storage, the seeds were germinated and grown on moist blotters. Radiation damage was measured as per cent reduction in seedling height from the control at 6 days. It was found that damage increased by as much as a factor of 20 after storage for a few weeks. There were two components to the curve of storage versus damage. The first component was rapid and nearly complete in 4 hours, whereas the second component was very slow and lasted many weeks. The moisture content of the seeds greatly influenced the magnitude of the effect and the nature of the curves obtained. Very dry seeds showed a large first component to the curve, whereas for moist seeds the first component was very small or absent. The second component was approximately the same for dry and moist seeds. There was no storage effect for seeds irradiated with fast neutrons. No clear explanation for these results can be given at the present time, but they are very similar to results which have been obtained on an after-effect of radiation in certain aqueous solutions. (auth)

9614

EFFECT OF GAMMA-IRRADIATION ON BLOOD COPPER AND MAGNESIUM IN THE BURRO. Thomas J. Haley, Anna M. Flesher, and Nathan Komesu (Univ. of California, Los Angeles). Radiation Research 8, 535-8 (1958) June.

The effects of chronic whole-body γ irradiation on plasma copper and magnesium have been studied in the burro. Plasma copper levels were significantly elevated prior to exitus whereas plasma magnesium levels were decreased. Normal plasma copper levels varied from 112 to 184 γ %, and plasma magnesium levels varied from 1.98 to 2.30 mg %. (auth)

9615

INHIBITION OF HeLa GROWTH BY INTRANUCLEAR TRITIUM. Robert B. Painter, Ruth M. Drew, and Walter L. Hughes (Brookhaven National Lab., Upton, N. Y.). Science 127, 1244-5(1958) May 23.

The inclusion of tritium-labeled thymidine of various concentrations in the tissue culture medium in which HeLa cells were grown resulted in inhibition of growth, except where carrier thymidine was added. The fact that added thymidine reversed the action of the tritium-labeled material was interpreted as demonstrating that the inhibition was the result of intracellular incorporation of tritium and not some toxic contaminant. Implications of the findings in studies using tritium-labeled compounds are discussed. (C.H.)

9616

CANCER FORMATION BY INDIRECT RADIATION EFFECTS. Ernst Stutz and Ursula Blüthgen (Universität Freiburg i. Br.). Strahlentherapie 105, 503-11(1958). (In German)

After fractioned x-ray treatment with high doses a 3-cm-long section from a rat's tail showed a considerably higher number of tumors, both benignant and malignant, compared to rats which had not been subject to x-ray treatment. These tumors occurred in most of the organs of the trunk. This latter had been exposed to a small x-ray dose, less than 1 r. Irradiations of the tail, with its strong blood circulation, means a considerable exposure to rays of the whole blood of the animal. The author considers the possibility of a genesis of the tumor by way of indirect effect carried out by radiation, and arising through a cancerogeneous factor in the blood in circulation, which was thus carried on to other organs and caused tumor formation. (auth)

9617

CANCER FORMATION IN RATS RECEIVING ACETYLAMINOFLUORENE AFTER SIMULTANEOUS FRACTIONATED 31 Mev IRRADIATION AND VITAMIN B_{12} TREATMENT. Merickston L. Nicholson (Universität Zürich). Strahlentherapie 105, 512-23(1958). (In German)

Tests were made on male and female albino rats that were fed 0.1% acetylaminofluorene, and examinations carried out on the influence of a simultaneous fractionated total betatron irradiation and vitamin B_{12} injections given at the same time. The simultaneously applied fractionated betatron treatment seems to check the development of liver carcinoma induced by acetylaminofluorene. Additional radiotherapy seems to have rather a life-lengthening effect. An additional vitamin B_{12} treatment appears to promote the growth of the acetylaminofluorene-induced liver carcinoma. The fractionated betatron total irradiation proved cancerogenic in 2 out of 10 animals; one developed a Mamma adenocarcinoma about 500 days after the beginning of the test, and the other developed a spindle-cell sarcoma in the neck region about 600 days after the treatment had begun. The vitamin B_{12} treatment alone had some life-shortening effect, but neither benign nor malign tumors could be found. (auth)

9618

THE EOSINOPHIL LEUCOCYTES AFTER FRACTIONATED SHORT PERIOD WHOLE BODY IRRADIATION. Helmut Widmann (Universität Tübingen, Germany). Strahlentherapie 105, 572-8(1958). (In German)

The author indicates the blood picture changes by means of average values that have been found with 20 rats after undergoing fractionated short-time irradiations of the whole body of doses that amounted to 50 r five times, and were applied within 14 days. The special sensibility of the eosinophil leucocytes, even towards fractionated irradiation, is stressed. The results show that the recuperation factor grows with increasing total irradiation periods. It must be assumed that while irradiation is in progress, regenerating and regressive changes are parallelly occurring in the hematopoietic tissue. Even in the case of an organism under the stress of irradiation, ACTH leads to a new fall in eosinophils while there is no such fall in lymphycytes. (auth)

9619

INVESTIGATION OF THE POTASSIUM SODIUM CONTENT IN VARIOUS ORGANS OF NORMAL RATS AND RATS WITH ADRENALECTOMIES AFTER WHOLE BODY IRRADIATION. Heinz Breuer, Heinz Karl Parchwitz, and Cuno Winkler (Chirurgischen Universitätsklinik und Poliklinik, Bonn). Strahlentherapie 105, 579-84(1958). (In German)

The potassium content in the spleen of normal rats fell after irradiation of the whole body with 2000 r, in the course of 72 hours after the irradiation, by about 20 μ-equiv./g. This was accompanied by a parallel increase in sodium content. The potassium content of the liver of the transversely striated muscular system increased after the irradiation, the increase observed in the kidneys being particularly noteworthy; this is probably due, partly, to the extracellular potassium concentration intensification, which is a consequence of the potassium loss of intracellular kind occurring in the organs sensible to radiation. Twenty-four hours after adrenalectomy, changes of the sodium and potassium contents of the examined organs were observed, but after another 24 hours had passed, a return to normal was found. Compared with non-operated animals, the 2000-r total irradiation of the body led to the loss of potassium after 48 hours with animals that had undergone adrenalectomy, this loss being stronger in the spleen, but there was also a potassium reduction in the liver and the muscular system. Sodium losses were equally recorded. (auth)

9620

THE EFFECT OF LARGE X RADIATION DOSES ON THE DEVELOPMENT OF THE HUMAN FETUS. Jolan Andriska, Gyula Frigyesi, György Kiszely, and Maria Nagy (Universität in Budapest). Strahlentherapie 105, 630-8(1958). (In German)

The present article establishes x-ray injuries a foetus suffered during the second and third month of pregnancy by an irradiation of 3600 r of the pelvis of the mother. The interruption of pregnancy and examination of the foetus took place almost three months after the irradiation. In spite of the large dose and the young embryonic age, absolutely no injuries could be found in the foetus by macroscopical inspection. The dissection showed agenesia of the corpus callosum. The histologic examination revealed chronic changes, particularly of the nervous system, but at the same time a certain regeneration of the injuries was already recognizable, i.e., the irradiation in first place caused a restraint in the pace of development. (auth)

9621

BIOCHEMICAL CHANGES IN THE PLANT ORGANISM AFTER IONIZING IRRADIATION. Ye. V. Budnitskaya. Uspekhi Sovremennoĭ Biol. No. 3, 280-91(1957) May-June.

A summary is presented of results from studies on the effects of ionizing radiation on plants. 84 references. (C.H.)

9622

CHANGES IN THE HISTOLOGICAL STRUCTURE OF EAR POLYPI CAUSED BY X-RAY TREATMENT. N. V. Zavadskiy. Vestnik Oto-Rino-Laringologii No. 3, 38-41(1957) May-June.

Changes are described in the histological structure of the middle ear observed during a course of x-ray treatment for ear polyps. (C.H.)

9623

MATERIALS FOR THE STUDY OF THE SPECIFICITY OF THE RESPONSE OF AN ORGANISM TO IRRADIATION. P. Domshlak, G. A. Avrunina, Yu. G. Grigor'yev, and N. G. Darenskaya. Vestnik Rentgenol. i Radiol. No. 2, 3-10(1957) Mar.-Apr.

The specificity of response of organisms to irradiation is discussed and substantiated by experimental data from studies using 400 mice and 115 rats. The biological effects of the same dose of radiation when administered internally and when administered externally were compared. The variation encountered was primarily in weight decrease. When irradiated internally by isotopes, animals started losing weight after 3 to 5 days, whereas under external irradiation, they lost weight from the very first day. Data are included on the radiosensitivity of the head, chest, and abdomen of rats. Encephalograms made on 17 patients undergoing roentgenological treatment were surveyed for direct and indirect effects of irradiation, on the central nervous system. Data are summarized from a survey of 4000 encephalograms. (C.H.)

9624

EFFECT OF IONIZING RADIATION OF THE HEMOLYSIS OF ERYTHROCYTES. A. P. Belousov. Vestnik Rentgenol. i Radiol. No. 3, 5-14(1957) May-June.

The saponin hemolysis method is a very effective way of determining the resistance of erythrocytes to radiolysis. The irradiation of rabbits with a dose of 700 r induces the formation of erythrocytes resistant to chemical hemolysis and the rapid disappearance from the blood stream of non-resistant ones. In the case of burns produced by boiling water, blood cell hemolysis is temporarily increased during a period of acute toxicosis. In rabbits irradiated with a dose of 1000 to 1300 r, intensive hemolysis of erythrocytes starts immediately and continues for up to 30 days. The appearance of resistant erythrocytes in the blood is preceded by a period of active hemopoiesis and the restoration of hemoglobin. Increased resistance of erythrocytes to saponin hemolysis has been observed in rabbits who suffered loss of blood and were subsequently irradiated. Irradiation of the blood in vitro in large doses, as contrasted to small doses, lowers the resistance of erythrocytes to chemical hemolysis. Changes in the resistance of erythrocytes to saponin hemolysis are conditioned by the direct action of radiation on the blood cells and the secondary effect of hemolysins. Thus, knowing the mechanism of the hemolysis of erythrocytes under the influence of ionizing radiation allows a better insight into the pathogenesis of radiation sickness and helps the development of protective means to prevent the onset of hemolysis. (auth)

Radiation Hazards and Protection

Refer also to abstract 9951.

9625

RADIOPROTECTORS AND TISSUE METABOLISM AFTER IRRADIATION. A. de Schryver, J. de Witte, I. Leusen, and P. M. van Vaerenbergh. Arch. intern. pharmacodynamie 106, No. 1-2, 181-3(1956). (In French)

The radioprotective effect of β-mercaptoethylamine on the utilization of oxygen by the spleen was studied in the rat. Rats were irradiated with 750 r, receiving 1 mg of β-mercaptoethylamine per 100 g of weight 2 min before the irradiation. Five days later the rats were decapitated and the spleen examined. The results showed that the rats treated with the β-mercaptoethylamine had a much higher utilization of oxygen than the untreated rats. The value was halfway between the non-irradiated rats and the unprotected rats. (J.S.R.)

9626

X IRRADIATION AND TISSUE RESPIRATION: EFFECTS OF CYSTEAMINE. A. de Schryver. Arch. intern. phys. biochim. 64, No. 4, 594-600(1956). (In French)

Five days after whole-body x irradiation of rats, weighing from 160 to 240 g, with a fatal dose of 750 r no modifications in the tissue respiration of the kidney and liver were observed. An average decrease of 25% was observed in the respiration of the myocardiac tissues. The preliminary administration of cysteamine suppresses the diminution of the respiration of the myocardiac tissues. Six hours after irradiation with 750 r, the utilization of oxygen by the spleen is depressed 21%. The preliminary administration of cysteamine reduces the diminution to 16%. The injection of cysteamine, considered as a radioprotector, does not seem by itself to affect the respiration of the spleen, myocardium, or liver. The injection of cysteine appears equally devoid of effects in the same conditions. (tr-auth)

9627

ON THE U. S. HEARINGS ON THE NATURE OF RADIOACTIVE FALL-OUT AND ITS EFFECT ON MEN. W. Herbst. Atomkern-Energie 3, 148-51(1958) Apr. (In German)

A brief summary is given of the U. S. hearings on the nature of radioactive fall-out and its effects on man. The horizontal spread of fall-out, the problem of the maximum permissible dose, the problem of future harm from fall-out, critical radionuclides in fall-out, and the magniture of the biological hazards were all considered. (J.S.R.)

9628

MEASUREMENT OF THE RADIOACTIVITY OF THE AIR DURING A SEA VOYAGE TO AUSTRALIA. S. Skorka (Univ. of Hamburg). Atomkern-Energie 3, 182-6(1958) May. (In German)

A filter paper collection method was used to measure the natural and artifical radioactivity of air during a voyage of "T.S.-Leipzig" from Europe to Australia during the months Sept. 1956 through Jan. 1957. The mean concentration of fission products was 3.6×10^{-12} $\mu c/cm^3$ of air. The maximum value, 124×10^{-12} $\mu c/cm^3$, was observed in Sydney 3 days after an atomic bomb had been exploded some 1000 km away. The mean radon content during the same period was 27×10^{-12} $\mu c/cm^3$. Unusual high contents of thoron have been found along the eastern and southern coast of Australia. (auth)

9629

EFFECTS OF SOME CHELATING AGENTS ON THE SURVIVAL OF IRRADIATED MICE. C. Corradi, R. Paoletti, and E. Pozza (Universitâ Milan). Atti soc. lombarda sci. med. biol. 12, No. 3, 3p.(1957). (In Italian)

White male mice were irradiated with a single dose of 1,000 r. Ten min. before the irradiation, the mice received an interperitoneal injection of some chelating agent equivalent to 1/3 or 1/6 of the lethal dose of the compound. Some of the chelating agents show a protective effect on the x-irradiated mice. Sodium diethyldithiocarbamate, sodium ethylenediaminotetraacetate, ammonium nitroso-phenyl-hydroxylamine, and sodium nitrilotriacetate show a more protective effect than the same quantities of cysteamine (with respect to the toxic doses). (auth)

9630

CERTAIN DATA CONCERNING CUMULATION OF POLONIUM^{210} BY WATER-LIVING ORGANISMS. V. Z. Agranat. Med. Radiol. 3, No. 1, 65-9(1958) Jan.-Feb. (In Russian)

Pronounced accumulation of polonium is revealed in fish living in water reservoirs with much lower specific activity of water, than the upper limit of permissible concentration (5×10^{-11} curie). This leaves in doubt the accuracy of the existing upper limit of permissible concentration of polonium in water of open water reservoirs and requires correction. (tr-auth)

9631

ON TRANSMISSION OF RADIOSTRONTIUM BY NUTRITIONAL CHAIN FROM THE OPENED WATER RESERVOIRS INTO THE HUMAN ORGANISM. A. N. Marei, M. M. Saurov, and G. D. Lebedeva. Med. Radiol. 3, No. 1, 69-76(1958) Jan.-Feb. (In Russian)

Water-living organisms (plankton, water plants, molluscs, fish) as well as domestic ducks concentrate a significant amount of isotopes in their tissues due to inhabiting water containing radiostrontium. Fish and ducks, which are the main links in the biological food-chain, transmit radiostrontium from the water reservoir into the human organism. The most significant is pollution of bone tissue, where most of the isotope is accumulated. It is passed into the broth in cooking of fish and poultry. The possibility of intake of radiostrontium not only with water, but with food products in amounts which are over the permissible levels, requires revision of standards of permissible concentrations for opened water reservoirs. (tr-auth)

9632

ALOE EMULSION — A NEW MEDICINAL AGENT. Ya. A. Aleshkina and B. K. Rostotskiy. Meditsinskaya Promyshlennost S.S.S.R. No. 4, 54-5(1957) Apr.

Aloe emulsion provided protection and proved effective in the treatment of second and third degree burns. Experiments on the radiosensitivity effects of the emulsion are described. (C.H.)

9633

EXPOSURE OF MAN TO IONIZING RADIATION ARISING FROM MEDICAL PROCEDURES. AN INQUIRY INTO METHODS OF EVALUATION. A Report of the International Commission on Radiological Protection and International Commission on Radiological Units and Measurements. R. M. Sievert, et al. Phys. in Med. Biol. 2, 107-50(1957) Oct.

In November 1956, the International Commission on Radiological Protection and the International Commission on Radiological Units and Measurements were invited by the United Nations Scientific Committee on

the Effects of Atomic Radiation to consider and discuss the question of how to arrive at reliable data indicating the doses to different parts of the body received by individuals and, in the aggregate, by large population groups due to the medical use of ionizing radiations. Dosimetry factors, methods of arriving at statistics, and methods for determining the gonad dose received from diagnostic and therapeutic applications of radiation are discussed. Data received from fourteen countries are included. (C.H.)

9634

EFFECT OF PYROGEN ON PHAGOCYTIC DIGESTION AND SURVIVAL OF X-IRRADIATED MICE. Eugene H. Perkins, Stanley Marcus, Ko Ko Gyi, and Fred Miya (Univ. of Utah Coll. of Medicine, Salt Lake City). Radiation Research 8, 502-8(1958) June.

Piromen in doses of 1 μg per injection administered twice daily for 3, 5, or 7 days significantly increased intracellular digestion of chicken erythrocytes by mouse phagocytes. Similar treatment with 0.1 μg of Piromen for 5 to 7 days also increased intracellular digestion. However, Piromen in doses of 0.1, 1, or 2 μg per injection administered twice daily for various intervals prior to and after x irradiation failed to increase survival of x-irradiated mice. (auth)

9635

FUTURE RADIATION DOSAGE FROM WEAPON TESTS. D. R. Inglis (Argonne National Lab., Lemont, Ill.). Science 127, 1222-7(1958) May 23.

A prediction is made of the effects of future nuclear weapons tests on the environment of man. For the sake of extrapolating into the future, three possible courses are considered. These include: testing will continue at its present rate; testing will close and only the residual radioactive burden in the stratosphere need be considered; and the rate of testing will continue to increase at the average rate at which it has increased since 1951. Expressions for the accumulated activities corresponding to these three assumptions are derived, and equations are presented as a basis for the calculated radiation dosages. (C.H.)

Radiation Sickness

9636

THE STATE OF THE INTERNAL FACTOR (CASTLE'S) AND VITAMIN B_{12} IN ACUTE RADIATION SICKNESS. S. S. Vasileiskii. Med. Radiol. 3, No. 1, 29-34(1958) Jan.-Feb. (In Russian)

Vitamin B_{12} content in the blood serum of dogs after total irradiation by x rays with a dose of 400 r is normal during acute radiation sickness, as well as in periods after it. Absorption of vitamin B_{12}, introduced per os, is also normal (the Castle's internal factor is preserved). Rat-reticular reaction becomes negative in the same dogs. This incoördination is not connected with inactivation of Castle's internal factor. This points to another difference in the properties of rat-reticulocytic reaction and the Castle's internal factor. (tr-auth)

9637

MORPHOLOGICAL CHANGES ON THE PERITONEUM IN ACUTE RADIATION SICKNESS. V. I. Ponomarkov. Med. Radiol. 3, No. 1, 50-7(1958) Jan.-Feb. (In Russian)

Investigations were carried out on 25 male rabbits irradiated with 1000 r in a three-tubular unit. Eleven rabbits died within the first few hours after irradiation and were not examined histologically. Fourteen rabbits which survived were killed at various periods, ranging from 1 to 20 days. The study of the peritoneum (omentum, diaphragm, appendix) was carried out by the method of total or planimetric preparations. (tr-auth)

9638

CERTAIN MEANS OF TREATMENT OF RADIATION INJURIES OF THE SKIN. G. F. Nevskaya. Med. Radiol. 3, No. 1, 57-64(1958) Jan.-Feb. (In Russian)

Clinical tests were conducted of the treatment by linol, linolen, and 2% methionine ointment. Observation was made of patients with moist radioepidermitis following radiation therapy. The above preparations proved to be effective in the therapy of subacute radiation injuries of the skin. The therapeutic effect of methionine ointment is slightly less than that of linol and linolen. (tr-auth)

9639

ON ABSORPTION OF DYSENTERY ENDOTOXINS IN RADIATION SICKNESS OF RABBITS. M. A. Tumanyan and F. M. Sosnovskaya (Gamalei Inst. of Epidemiology and Microbiology, Academy of Medical Sciences, USSR). Med. Radiol. 3, No. 2, 46-9(1958) Mar.-Apr. (In Russian)

It was demonstrated in previous work with labeled atoms that dysentery endotoxins are absorbed from intestines into the blood stream when introduced to rabbits per os. They are revealed in the blood within half an hour after administration. When rabbits were irradiated by LD 50, the intensity of absorption of dysentery endotoxin was changed. It increased during the first 24 hours after irradiation, then this process normalized for a short time. Next it was replaced by a stable increase of absorption which began at the end of the first week and continued for 3 to 4 weeks after irradiation. (tr-auth)

9640

CHANGES OF THE BLOOD IN CHRONIC RADIATION SICKNESS. M. S. Lapteva-Popova. Med. Radiol. 3, No. 2, 53-61(1958) Mar.-Apr. (In Russian)

The changes of peripheral blood and bone marrow were studied in 17 dogs beginning with the initial reactions and up to the lethal outcome. These dogs were irradiated by x rays for a number of years in the dose of 5 or 10 r. These investigations showed that reaction of the organism is manifested by alternation of the periods of increase of the symptoms of chronic radiation sickness with the periods of stabilization of the temporary compensation of the process. Sequence of development of the above periods, the time of survival of the animals, and other specific features in the development of this disease varied depending on the daily doses of irradiation (5 or 10 r) and individual characteristics of the organism. The results of the chronic radiation sickness were aplastic or hyperchromic macrocytic anemias and leukoses. There were no diseases or significant changes in the blood picture in the control group of animals, kept in the same conditions as the experimental animals. (tr-auth)

9641

THE EFFECT OF INTRAVENOUS INTRODUCTION OF NOVOCAIN ON THE COURSE OF RADIATION SICKNESS. S. P. Sizenko and V. V. Markevich (Kiev Research Roentgen-Radiological and Oncological Inst.). Med. Radiol. 3, No. 2, 72-7(1958) Mar.-Apr. (In Russian)

Preliminary intravenous introduction of the novocain solution in the dose of 0.08 to 0.1 cc per kg of body weight decreases the effect of x-ray and γ-ray irradiation (LD-50) on the organism of the animal. It is mani-

fested by a less severe course of the radiation sickness, an increased number of surviving animals, a prolongation of life, and a less pronounced reduction in weight. Introduction of the novocain solution following the irradiation has no therapeutic effect on the course of radiation sickness and in certain cases even aggravates it. Leukopenia is less marked in animals with preliminary novocain administration as compared to control animals. (tr-auth)

9642

CERTAIN DATA CONCERNING ADMINISTRATION OF UROTROPIN IN TREATMENT OF RADIATION SICKNESS. M. P. Domshlak and L. B. Koznova. Med. Radiol. 3, No. 2, 78-80(1958) Mar.-Apr. (In Russian)

Urotropin was administered in pronounced manifestations of radiation sickness which followed the treatment. Intravenous injection of 40% solution of urotropin in the dose of 5.0 cc resulted in arrest of nausea and vomiting in 15 to 30 minutes after the infection. These symptoms disappeared in 24 hours when urotropin was administered per os (0.5 gm 3 to 4 times a day). (tr-auth)

9643

THE COURSE OF EXPERIMENTAL HEMOTHORAX IN RADIATION SICKNESS. Chzhu Chzhun lin. Vestnik Khirurg. No. 5, 104-9(1957) May.

Experimental hemothorax induced by injecting 10 to 12 ml of autogenous blood into the pleural cavity of healthy rabbits was borne well without any marked general reaction. Rabbits irradiated with 600 r were more affected by experimental hemothorax. Instead of absorption, exudation accumulated in the pleural cavity. In rabbits irradiated with 600 r, experimental hemothorax markedly shortened the latent period of radiation sickness and hastened its climax. (C.H.)

9644

ON A RELAPSE IN RADIATION SICKNESS. V. N. Borob'yev. Vestnik Rentgenol. i Radiol. No. 3, 3-5 (1957) May-June.

An attempt was made to produce a relapse of radiation sickness in guinea pigs just recovered from acute radiation sickness by means of a fracture of the femur. During the subsequent ten days only a slight increase was observed in number of leukocytes, the weight remained normal, and the general condition remained good. (C.H.)

9645

CONCERNING BRAIN LESIONS IN RADIATION SICKNESS. S. Shershever. Zhur. Nevropatol. i Psikhiatrii No. 3, 393-401(1957).

Three dogs were subjected to doses of 1000 and 1500 r x radiation exposure of the head. Ten dogs were subjected to head irradiation of 1500 r repeated in two or three days and 510 r irradiation of the back along the spine. Morphological examination of tissues revealed predominant lesions of nerve cells of cortex, disorders of the permeability of the vascular walls, and effects on the cerebellum, Ammon's horn, pons varolii, and medulla oblongata. (C.H.)

9646

THE EFFECT OF NARCOSIS AND NATURAL HIBERNATION ON THE RADIOSENSITIVITY OF ANIMALS. M. D. Pomerantseva (Inst. of Genetics, Academy of Sciences, USSR). Zhur. Obshcheĭ Biol. No. 3, 194-207 (1957) May-June.

The radiosensitivity of animals under deep narcosis and in a state of hibernation was investigated. Several hundred mice were exposed to doses of x radiation of 500, 1500, 4000, and 10,000 r. The protection afforded by the administration of sodium Nembutal, Barbamil, Hedonal, Urethane, and ether both before and after irradiation was investigated. The effect of hibernation on the radiosensitivity of animals was investigated in the rodent, Citellus major, following exposure to 600 r x radiation, and hedgehogs exposed to doses of 700 to 850 r. Data are tabulated and presented graphically. The use of narcosis after irradiation of the mice proved ineffective in reducing radiation damage. The use of Nembutal, Barbamil, and ether to produce narcosis during irradiation increased the resistance of mice to the action of 500 r x radiation as demonstrated by an increase in survival rate, delay in time of death, and faster restoration of body weight. The use of Hedonal and Urethane for narcosis was practically ineffective. The use of oxygen decreased in mice under narcosis induced by Nembutal and Barbamil. Deep Nembutal narcosis was found to delay, until the subject awakens, the early reactions against irradiation with massive doses of x radiation. The natural hibernation of animals did not increase their radioresistance to lethal doses of x radiation but delayed, until awakening, the onset of acute symptoms of radiation sickness. (C.H.)

Radiography

9647

NEW DESIGN OF A LINEARIZING RECORDING DENSITOMETER. James Donald Nelson (Leeds & Northrup Co., Philadelphia) and Pauline Beery Mack and George Parlin Vose (Texas Woman's Univ., Denton). Rev. Sci. Instr. 29, 316-17(1958) Apr.

In the design and construction of a recording densitometer intended primarily for the evaluation of bone density, a potentiometric system has been substituted for the electromechanical function transformer. In the application of this technique, a wedge is used as a standard object of reference, with the wedge exposed to x rays simultaneously with the exposure of the bone. The present type of wedge has a continuous and constant slope and is made of an aluminum alloy with x ray absorption characteristics similar to those of bone. The pattern wedge obtained on the film reflects film exposure and development conditions. Its densitometric curve provides the necessary data needed for correcting the bone scan for integration purposes. (W.D.M.)

Radiotherapy

9648

ON THE PROBLEM OF RADIATION REACTIONS AND RADIATION SICKNESS. G. A. Zedgenidze, I. S. Amosov, and L. F. Sinenko. Med. Radiol. 3, No. 2, 3-10(1958) Mar.-Apr. (In Russian)

The syndrome of acute radiation sickness may appear not only when the general external irradiation is applied, but also by the action of large doses of penetrating radiation on spearate areas of the organism, especially on the abdominal and thoracic organs. A mild form of radiation sickness was observed in 406 patients (42.7%), and of average degree in 9 patients who suffered from malignant tumors and were treated by roentgenradiotherapy. Although the total dose equalled 6,000 to 30,000 r, there were no grave forms of radiation sickness in these patients due to the prophylactic measures. The functional changes were found in the bronchopulmonary system, gastrointestinal tract, liver, gall bladder, and kidneys. These changes were revealed

by a thorough clinico-roentgenological examination and appeared during the primary radiation reaction or in 3 to 4 weeks of treatment. The functional disturbances of the internal organs were usually found prior to the development of the anatomical changes. (tr-auth)

9649

SELECTION OF GAMMA-RAY EMITTING ISOTOPES AS PERMANENT IMPLANTS IN THE TREATMENT OF CANCER. Lionel Cohen (General Hospital, Johannesburg, South Africa). Phys. in Med. Biol. 2, 229-33 (1958) Jan.

It is shown that the optimal biological dosage factors for permanent implants of gamma-ray emitting radioactive sources can be estimated by using empirical formulae relating the observed reactions of irradiated squamous cancer and normal human skin to the physical dosage, the relative biological efficiency of the radiation used, the size of the treated field, and the time-parameter appropriate to the exponentially decaying source. On this basis the optimal initial dose-rates (r/hr) or, in the case of discrete grains, the optimal initial millicurie content per grain, for interstitial application of Au^{198}, Rn^{222}, Bi^{206}, I^{131}, Ba^{140}–La, Cr^{51}, Ir^{192}, and Ta^{182} are tabulated. The longer-lived materials are shown to have certain advantages, and it is suggested that moderately long-lived sources with half-lives of the order of 20 days are likely to prove clinically superior to conventionally used materials. (auth)

9650

THERAPEUTIC USE OF RADIOACTIVE COBALT IN LARYNGOLOGY. K. N. Chochia and A. B. Polezhayev. Vestnik Oto-Rino-Laringologii No. 4, 52-6(1957) July-Aug.

Two hundred patients with malignant tumors of the larynx were treated with a teletherapy unit employing cobalt-60 as a gamma source. Daily irradiation doses ranging from 250 r up to total doses of 10,000 r were used. Clinical results are reported. (C.H.)

Toxicology Studies

9651

PROBLEMS OF TOXICOLOGY OF RADIOACTIVE SUBSTANCES. D. I. Zakutinskii. Med. Radiol. 3, No. 1, 3-8(1958) Jan.-Feb. (In Russian)

A review of biological effects induced by radioactive substances is presented. (R.V.J.)

9652

THE Sr^{90} CONTENT OF MILK IN THE YEARS 1955–1957. Ernst Knoop and Dietrich Merten (Bunderforschungsanstalt fur Milchwirtschaft in Kiel, Germany). Naturwissenschaften 45, 194(1958). (In German)

The increase in the Sr^{90} content of milk in the German Republic was determined for the years 1955 to 1957. Powdered milk samples with origin from all parts of the republic were analyzed. The results are graphed. Although, because of geographic, meteorological, and feeding factors, there is a strong scattering of the Sr^{90} content, a steady upward trend is quite evident. The results agree with those found in other countries. (J.S.R.)

9653

RADON RETENTION IN RADIUM-INJECTED BEAGLES. C. W. Mays, M. A. Van Dilla, R. L. Floyd, and J. S. Arnold (Univ. of Utah, Salt Lake City). Radiation Research 8, 480-9(1958) June.

Fractional radon retention is similar in rats, dogs, and man at equal times after radium injection. Fractional radon retention increases with time after radium deposition. This is attributed to increase in mineral density, increase in crystal size, and decrease in diffusion coefficient as bone crystals mature. Fractional radon retention is similar among whole bones in a given animal, but much lower in teeth. A mathematical theory expressing fractional radon retention in terms of mineral density, crystal size, and diffusion coefficient is discussed. (auth)

Tracer Applications

9654 COO-216

Utah. Univ., Salt Lake City.

ESCAPE OF RADON AND THORON WHEN PRODUCED IN BONE (thesis). Charles William Mays, Jr. Mar. 1958. 54p. Contract AT(11-1)-119. $9.30(ph OTS); $3.60(mf OTS).

The metabolism of radium-226, radium-228, and thorium-228 was studied following injection in dogs. Data are tabulated on whole-body retention and radon retention in individual bones and teeth. A mathematical theory of radon retention in body tissues is derived and discussed. (C.H.)

9655

ON THE ABSORPTION OF RADIOACTIVE PHOSPHORUS FROM THE PLEURAL CAVITY. V. R. Faytel'berg-Blank and Yu. B. Sosyura. Byull. Eksptl'. Biol Med. No. 3, 64-8(1957) Mar.

Experiments on 15 rabbits indicate that radioactive phosphorus is very rapidly absorbed from the pleural cavity following intrapleural injection. Artificial pneumothorax slowed absorption of the radiophosphorus and increased deposition in the liver and lungs as compared with non-operated rabbits. The concentration of radiophosphorus was higher in the non-collapsed lung. (C.H.)

9656

CHOLESTEROL BIOSYNTHESIS. STUDIES RELATED TO THE METABLIC ROLE OF SQUALENE. Maxwell L. Eidinoff, Joseph E. Knoll, Benjamin J. Marano, Elling Kvamme, Robert S. Rosenfeld, and Leon Hellman (Sloan-Kettering Inst. for Cancer Research, Memorial Center, New York). J. Clin. Invest. 37, 655-9(1958) May.

A hydrocarbon fraction containing squalene labeled with tritium was prepared by the reaction of squalene with tritium-containing water in the presence of a platinum catalyst. On oral administration of this hydrocarbon fraction in the human, the tritium content of the plasma-free cholesterol reached a maximum within 7 to 21 hours. Calculations based on these data indicated that over 20 per cent of the administered tritium label was converted to cholesterol tritium. Incorporation of the labeled squalene into the liver cholesterol of mice was also demonstrated. These results furnish direct support for the hypothesis that squalene, or a closely related compound, is an important intermediate in the synthesis of cholesterol by the human. The in vivo synthesis of squalene from acetate precursor was used to prepare squalene-C^{14} for metabolic studies. On intraperitoneal administration of acetate-2-C^{14} to a dog, approximately 0.1 per cent of the administered radiocarbon activity was present in the liver squalene after one hour. The labeled squalene was administered to mice and the radiocarbon content of cholesterol, fatty acids, and respiratory carbon dioxide measured. Less

than 1 per cent of the administered radiocarbon was eliminated as respiratory carbon dioxide in a seven hour period following administration. After this time, the mouse lipid fatty acids contained less than 2% of the radiocarbon in the administered squalene. (auth)

9657

TOTAL EXCHANGEABLE SODIUM, TOTAL EXCHANGEABLE POTASSIUM, AND TOTAL BODY WATER IN EDEMATOUS PATIENTS WITH CIRRHOSIS OF THE LIVER AND CONGESTIVE HEART FAILURE. L. W. Birkenfeld, J. Leibman, M. P. O'Meara, and I. S. Edelman (Univ. of California School of Medicine, and the San Francisco Hospital). J. Clin. Invest. 37, 687-98(1958) May.

Total exchangeable sodium, total exchangeable potassium and total body water were determined in non-edematous hospitalized controls and in edematous patients with cirrhosis of the liver and chronic congestive heart failure with the use of Na^{24}, K^{42} and D_2O as tracers. (auth)

9658

THE DEPOSITION OF THE RARE EARTHS IN BONE. J. Jowsey, R. E. Rowland, and J. H. Marshall (Argonne National Lab., Lemont, Ill.). Radiation Research 8, 490-501(1958) June.

After intraperitoneal injection, the rare earth isotopes Y^{91}, Ce^{144}, and Tm^{170} are taken up in the skeleton and appear on nongrowing bone surfaces that microradiographs show to be highly calcified. They are not found in osteoid tissue. These three isotopes remain in the inorganic fraction of bone after ethylenediamine extraction of the organic fraction from the bones of injected animals. Bone mineral will take up these rare earth elements from plasma in vitro; organic material from bone will not. The three rare earth isotopes investigated are taken up by bone mineral and are localized on the available resorbing and inactive surfaces of bone tissue. (auth)

CHEMISTRY

9659 AFOSR-TR-58-49

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

A STUDY OF A FAMILY OF LAVES-TYPE INTERMEDIATE PHASES. Final Technical Report. Rodney P. Elliott. Feb. 21, 1958. 17p. Project B-113. Contract AF-18(603)-130. (AD-154199).

Ternary alloys between binary Laves-type phases of transition elements were used to investigate the valencies of the transition elements. Systems containing constant atomic proportions of niobium, tantalum, and hafnium indicate, as had previous systems containing titanium and zirconium, that the valencies of the first transition series decrease continuously with increasing atomic number. On the basis of the previously calculated valencies, values between three and four were calculated for the valencies of niobium, molybdenum, hafnium, tantalum, and tungsten. Limited data indicate that the valencies of the second and third transition series increase and then decrease with increasing atomic number. Generalizations concerning the variation of valency for a given group could not be made. Unreconcilable data indicate that factors other than the free electronic valency are affecting the free energy and hence the miscibility ranges of the ternary Laves phases. (auth)

9660 AGC-AE-39

Aerojet-General Corp., Azusa, Calif.

REACTION OF ZIRCALOY-2 WITH WATER AND WITH URANYL SULFATE FUEL SOLUTION. Monthly Progress Report No. 4 [for] October 1 through October 31, 1957. Nov. 27, 1957. 9p. For Oak Ridge National Lab. Contract [W-7405-eng-26], Subcontract No. 1089. (AGC-L3501-01-4). $1.80(ph OTS); $1.80(mf OTS).

The following conclusions were reached, based on a qualitative analysis of these data: there is no appreciable difference between uranyl sulfate fuel solution and water as an oxidant for molten Zircaloy-2 droplets; the reaction of molten Zircaloy-2 with aqueous solutions is not self-sustaining when the droplets are larger than 20 μ and when there is an excess of the aqueous solution; minor alloying additions in zirconium-base alloys do not materially affect the extent of the reaction under the conditions of these tests; the data provide additional evidence to support earlier conclusions that the zirconium–water reaction is a process involving chemisorption of oxygen molecules on the surface of the metal. The fact that the addition of small amounts of electrolytes to the water has only a second-order effect on the reaction rate is consistent with this conclusion. (auth)

9661 HW-56137

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NON-METALLIC MATERIALS EVALUATION [FOR] JANUARY–MARCH 1958. J. H. Kleinpeter. May 8, 1958. 5p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The following materials were tested by static immersion at room temperature in HNO_3, NaOH, CCl_4, Recuplex CAX, Purex HAX, 4-methyl-2-pentanone, and distilled water: glass-bearing epoxy material, Carboline 700-2, Sauereisen Adhesive Cement No. 1, Carboline 2710, Pro-fax (polypropylene), Viton A rubber, and Mycalex 400. Also tested in $HCl–HNO_3$ solutions were polyethylenes, Teflon, Kel-F, vinyl chloride polymer, Hypalon rubber, CSGBF graphite, Penton, and 1F-4 rubber. (T.R.H.)

9662 SCL-T-178

ON CERTAIN INSPECTION SCHEMES OF RAW MATERIALS. (O Nekterych Prejimacich Zpusobech Surovin.) Vratislav Horalek. Translated from Apl. Mat. 2, 370-86(1957). 25p.

Theoretical inspection of three methods used in sampling raw materials (liquids, powders, and similar products) is considered. The influence of faulty chemical analysis on the effectiveness of particular inspection schemes is also shown, and conclusions are derived for preparation of a number of the samples. Simultaneously the questions of errors are solved of the first and the second kinds which originate in judging the quality of the analyzed sample. (auth)

9663 UCRL-5148

California. Univ., Livermore. Radiation Lab.

THE PREPARATION OF BIARSINE. Duward F. Shriver and William L. Jolly. Feb. 19, 1958. 18p. Contract W-7405-eng-48. $0.75(OTS).

Biarsine (As_2H_4) may be prepared by the passage of arsine (AsH_3) through either a silent electric discharge tube or a tube containing a hot tungsten filament. The experimental conditions for these processes were varied so as to find the optimum conditions for the preparation. Small yields of biarsine may also be obtained by the electrolysis of an aqueous arsenious acid solution. However, this method has not been thoroughly studied because the preceding methods are much better.

Analytical methods and a technique for handling biarsine with a minimum of decomposition have been developed. (auth)

9664 UCRL-8204

California. Univ., Berkeley. Radiation Lab.
BIO-ORGANIC CHEMISTRY QUARTERLY REPORT [FOR] DECEMBER 1957, JANUARY, FEBRUARY 1958. Mar. 11, 1958. 35p. Contract W-7405-eng-48. $1.00(OTS).

Research is reported on the proton magnetic resonance of organic compounds containing nitrogen, electron-spin resonance of irradiated choline chloride and its analogs, isotope effect in decarbonylation of benzoylformic acid, distribution of radioactivity in $C_6H_5CH_3$ formed from C_6H_6 and photolyzed diazomethane-C^{14}, luminescence of green plant materials, biosynthesis of morphine alkaloids, effects of hydroxylamine on the $C^{14}O_2$ fixation pattern during photosynthesis, and pre-incubation of carboxydismutase with metal ions. (For preceding period see UCRL-8141.) (T.R.H.)

9665 WAPD-CP-687

[Westinghouse Electric Corp.] Atomic Power Div., Pittsburgh.
STABILITY OF BORIC ACID. H. K. Lembersky. Sept. 14, 1954. 4p. $1.80(ph OTS); $1.80(mf OTS).

Boric acid is sufficiently stable at 600°F and 2000 psi in conditioned dynamic systems for use in reactors. (auth)

9666 AEC-tr-3220

THE KINETICS OF THE FORMATION OF CALCIUM HYDRIDE. V. A. Shushunov and A. I. Shafiev. Translated from Zhur. Fiz. Khim. 26, 672-9(1952). 11p.

The reaction between calcium and hydrogen from 120 to 530°C proceeds without spontaneous acceleration, the rate being determined under some conditions by the hydrogen diffusion rate through the hydride layer. The apparent activation energy of the chemical process is equal to 5500 cal/mole, while the diffusion activation energy is equal to 15,000 cal/mole. Traces of oxygen and water vapor in the hydrogen lower the rate of the reaction. (J.R.D.)

9667 AEC-tr-3232

THE KINETICS OF THE REACTION BETWEEN CALCIUM AND HYDROGEN. V. A. Shushunov and A. I. Shafiev. Translated from Doklady Akad. Nauk S.S.S.R. 78, 1181-4(1951). 5p.

The relationship between temperature and the rate of chemical process in the reaction between calcium and hydrogen was investigated to confirm a hypothesis that unstable intermediate reaction products in some reactions are the cause of Arrhenius' law not being followed. It was pointed out that the law of Arrhenius was followed in the reaction, indicating the correctness of the hypothesis since the formation of CaH_2 should involve the formation of no unstable intermediate products. (J.R.D.)

9668

EFFECT OF CESIUM ON CARBON DIOXIDE. Louis Hackspill and Ralph Setton. Compt. rend. 246, 2430-6(1958) Apr. 28. (In French)

Carbon dioxide will react with cesium. If the cesium is in thin layers at approximately 0°, a blue-black compound with the formula Cs_2CO_2 is obtained. This compound hydrolyzes to give a molecule of cesium formate for each molecule of the hydroxide CsOH. (tr-auth)

9669

VAPOR-PHASE PHOTOCHEMISTRY OF TRANS-METHYL PROPENYL KETONE. R. S. Tolberg and J. N. Pitts, Jr. (Northwestern Univ., Evanston, Ill. and Univ. of California, Riverside). J. Am. Chem. Soc. 80, 1304-9(1958) Mar. 20.

The vapor-phase photolysis of pure trans-methyl propenyl ketone (trans-3-penten-2-one) was studied over a wide range of temperatures, pressures and wave lengths. This α,β-unsaturated ketone is unusually stable toward photo-dissociation into radicals. At 25° from 3130 to 2380 Å. and at 3130 Å. and temperatures up to 275°, a photo-rearrangement of the trans to the cis isomer is the only significant reaction. At 2380 Å. and above 125°, reactions leading to non-condensable products become important. Φ_{CO} exceeds unity at 275° and pressures below 10 mm. Other non-condensable products are 2-butene, methane, propene and ethane in decreasing order of abundance. At 200 and 275°, the reciprocals of the quantum yields of CO, C_4H_8, C_3H_6, and CH_4 are directly proportional to pressure but independent of intensity. The ratios C_4H_8/CO, C_3H_6/CO, and CH_4/CO are independent of pressure. Methyl isobutyl ketone is apparently a condensable product. A mechanism is proposed in which the primary process is formation of a photo-excited molecule. (auth)

9670

CLEAVAGE STUDIES OF SIMPLE AROMATIC BORONIC ACIDS. Henry Gilman, D. R. Swayampati, and R. O. Ranck (Iowa State Coll., Ames). J. Am. Chem. Soc. 80, 1355-7(1958) Mar. 20.

Benzeneboronic acid and o-hydroxybenzeneboronic acid anhydride were cleaved with n-butyllithium and the products characterized by carbonation. Benzeneboronic acid gave either 1-butaneboronic acid, benzoic acid or benzene, or a combination, the products depending upon the temperature at which the cleavage was run. o-Hydroxybenzeneboronic acid anhydride gave salicylic acid as one of the products. The cleavage of o-hydroxybenzeneboronic acid anhydride with hydrogen peroxide and bromine behaved normally. (auth)

9671

THE HEAT, FREE ENERGY AND ENTROPY OF THE FERRATE(VI) ION. Robert H. Wood (Univ. of California, Berkeley). J. Am. Chem. Soc. 80, 2038-41(1958) May 5.

The heat of the reaction of aqueous K_2FeO_4 with perchloric acid (0.5 mole per kg of water) to give O_2 and Fe^{+3} has been measured at 25°. From this datum the heat of formation of $FeO_4^=$(aq.) ($\Delta H_f^0 = -115 \pm 1$ kcal/mole) has been calculated. The entropy of $FeO_4^=$(aq.) has been estimated as 9 ± 4 e.u. From these values the free energy of formation of $FeO_4^=$(aq.) has been calculated; it is $\Delta Ff^0 = -77 \pm 2$ kcal/mole. The standard electromotive force of the half reaction $Fe(OH)_3 + 5OH^- \rightarrow FeO_4^= + 4H_2O + 3e^-$ has been estimated as $E^0 = -0.72 \pm 0.03$ volt. It has been verified that the ferrate ion at pH 10 is a dinegative species which decomposes only slowly. A method of analysis for aqueous K_2FeO_4 has been developed in which ferric hydroxide is removed by filtration and the total iron present is measured. This analysis has been shown to be accurate to better than ±1% by comparison with the volume of oxygen liberated on acidifying an aqueous K_2FeO_4 solution. The absorption spectrum of K_2FeO_4 has been measured. (auth)

9672

THE ELECTRICAL CONDUCTIVITY OF SOLUTIONS OF ALKALI METALS IN THEIR MOLTEN HALIDES. H. R. Bronstein and M. A. Bredig (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 80, 2077-81(1958) May 5.

The electrical conductivity of alkali metal solutions in their molten halides has been measured by means of a synthetic sapphire conductance cell. The specific conductance increases with increasing metal concentration. The equivalent conductance of K, Λ_K, in both KCl and KBr also increases, namely, from 2800 ohm^{-1} cm^2 (K–KCl, 820°), 6100 (K–KBr, 760°), and 6500 (K–KBr, 870°) at infinite dilution, to 38,000, 83,000, and 71,000 ohm^{-1} cm^2 at 19, 23, and 20 mole % K, respectively, the maximum concentrations measured. However, Λ_{Na}, for Na in NaBr at 895° decreases from 12,500 to a minimum of 7300 ohm^{-1} cm^2 at ca. 9 mole % metal. At 805° Λ_{Na} in NaBr decreases from ca. 12,000 at infinite dilution, i.e., approximately the same value as at 895°, to less than 5000, and in NaCl at both 845 and 890° from ca. 6000 to less than 3000 ohm^{-1} cm^2. These values are the equivalent conductances at 5, 4 and 3 mole % Na, respectively, representing the metal solubility limits which are too low to permit the equivalent conductance minima to be realized. The different behavior of sodium and potassium may be related to the liquid phase equilibria and to the dissociation energies known for the diatomic gaseous metal molecules, both of which reflect a greater tendency to associate for Na than for K at the test temperatures. Such association, which increases with metal concentration, decreases the number of metal particles per equivalent of metal on which the electronic fraction of the conductance is thought to depend. The effect of the association, not strong enough in the K systems to produce a minimum in equivalent conductance, is, in the Na systems, surpassed, at the minimum, by the effect of the gradual establishment of the metallic conductance band through overlap of the orbitals of the metal polymers. The differences in equivalent conductance at infinite dilution for the various systems may be taken to reflect the influence of the different degrees of polarization of the anions by the cations on electron mobility. (auth)

9673

THE KINETICS OF THE EXCHANGE OF CHLORINE BETWEEN HYDROGEN CHLORIDE AND ACETYL CHLORIDE IN THE VAPOR PHASE. Warren J. Neill and Milton Kahn (Univ. of New Mexico, Albuquerque). J. Am. Chem. Soc. 80, 2111-12(1958) May 5.

A measurable exchange has been observed between hydrogen chloride and acetyl chloride in the vapor phase. The exchange reaction was investigated over a temperature range from 0 to 29.6°; the concentration of acetyl chloride ranged from 0.0026 to 0.0106 M and of hydrogen chloride from 0.0031 to 0.0080 M. Over the range of conditions studied the rate of exchange can be represented by $R = 0.17e^{-1550/RT}$ (HCl) (CH_3COCl) where the units of R are liter × $mole^{-1}$ × sec^{-1}. A more complicated rate expression cannot be excluded but is not called for by the data. (auth)

9674

THE SIMULTANEOUS MEASUREMENT OF DISTRIBUTION COEFFICIENTS AND HYDROLYSIS RATES. Elias Klein, John B. McKelvey, and Beverly G. Webre (Southern Regional Research Lab., New Orleans, La.). J. Phys. Chem. 62, 286-8(1958) Mar.

When butadienediepoxide is reacted with cotton cellulose in the presence of aqueous sodium hydroxide, a three-phase reaction system is involved. Two of the important parameters are the distribution of the reagent between the organic and aqueous phases, and the rate of hydrolysis of the reagent in the latter. A technique of measurement of the distribution coefficient and the hydrolysis rate as a function of the base strength is presented. (auth)

9675

PARTIAL MOLAL VOLUMES OF IODINE IN VARIOUS COMPLEXING AND NON-COMPLEXING SOLVENTS. Kōzō Shinoda and J. H. Hildebrand (Univ. of California, Berkeley). J. Phys. Chem. 62, 295-6(1958) Mar.

Results of volume measurements in 25 solvents at mole fractions less than 0.002 are reviewed along with various comparisons of individuals and classes solvents. (J.R.D.)

9676

EFFECT OF THERMAL GRADIENTS ON METAL-GAS SYSTEMS. George G. Libowitz (Atomics International, Canoga Park, Calif. and Tufts Univ., Medford, Mass.). J. Phys. Chem. 62, 296-8(1958) Mar.

The distribution of a gas dissolved in a metal under a thermal gradient and constant pressure is considered. An expression for the concentration gradient is derived. The effect of compound formation on the distribution and on the shape of pressure–composition isotherms is discussed. (auth)

9677

LIABILITY OF Cr(IV) TO SUBSTITUTION. Allen E. Ogard and Henry Taube (Univ. of Chicago). J. Phys. Chem. 62, 357-8(1958) Mar.

The dissociation of $CrCl^{2+}$ in acid solution as it is induced by a 1 e^- oxidizing agent was studied. The oxidizing agent used was Mn^{3+}, and the rates of dissociation were calculated from initial changes in optical density. (J.R.D.)

9678

A SIMPLIFIED EXPRESSION FOR THE MOLAR POLARIZATION OF SOLUTES. Kenneth A. Allen (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 62, 363-4 (1958) Mar.

The dielectric constant of solutes at low concentrations should be a linear function thereof, and equations based on this linearity, plus the linearity of the specific volume, has been proposed which give unambiguous values of molar polarization at zero concentration. An alternative expression is presented which is mathematically equivalent, but more simply and easily used. (J.R.D.)

9679

THE SOLUBILITY OF XENON IN SOME HYDROCARBONS. H. Lawrence Clever (Duke Univ., Durham, N. C.). J. Phys. Chem. 62, 375-6(1958) Mar.

The solubility of xenon has been determined at a total pressure of one atmosphere and temperature of 16, 25, 34.5, and 43°C in benzene, cyclohexane, n-hexane, isoöctane, and n-dodecane. (auth)

9680

THE SURFACE CHEMISTRY OF BONE MINERAL. X. THE LACK OF INTERACTION BETWEEN SODIUM AND CARBONATE IONS. W. R. Stoll and W. F. Neuman (Univ. of Rochester, N. Y.). J. Phys. Chem. 62, 377-9(1958) Mar.

Both sodium and carbonate ions have previously been shown to be incorporated in the surface of hydroxy apatite crystals by ion exchange processes. Because, in bone in vivo, these two ions appear to be related, an attempt was made to test whether any specific interaction between sodium and carbonate ions occurs at the hydroxy apatite surface in vitro. Carbonate ions did increase incorporation by apatite of both sodium and potassium ions but the effects were small and nonspecific. The association between sodium and carbonate ions in bone is, therefore, probably the result of physiological mechanisms. (auth)

9681

COMPLEX IONS IN FUSED SALTS. F. R. Duke and M. L. Iverson (Iowa State Coll., Ames). J. Phys. Chem. 62, 417-19(1958) Apr.

The complex formation constants for a series of bivalent metal halides were determined using fused KNO_3-NaNO_3 eutectic as solvent. The method involved measuring the increase in solubility of the slightly soluble metal chromate as halide ion was added. (auth)

Analytical Procedures

9682 AECU-3687

Michigan. Univ., Ann Arbor.

POLAROGRAPHY, Report No. 33. Charles L. Rulfs and Philip J. Elving. Apr. 25, 1958. 15p. Contract AT(11-1)-70, Project 8. $3.30(ph OTS); $2.40(mf OTS).

To be in "Dictionary of Physics."

A brief introduction to the nature and applicability of polarography and voltammetric techniques in general has been prepared for publication in a multivolume Dictionary of Physics, which is being published by an English publisher. The review covers the experimental fundamentals of polarography, the manner in which the data are interpreted, the physical phenomena which produce the observed experimental findings, current developments which stem from polarography, and the applicability of polarography to chemical analysis and to other research and applied areas of chemistry. (auth)

9683 AERE-C/R-2117

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SPECTROGRAPHIC DETERMINATION OF CALCIUM AND ZIRCONIUM IN BISMUTH-URANIUM ALLOYS. R. C. Smart and M. S. W. Webb. Dec. 1957. 10p.

Bismuth alloys were converted to oxides, lanthanum was incorporated as an internal standard, and 5 mg charges were cemented to copper electrodes by means of a thermosetting resin. Samples were excited by a triggered uni-directional discharge, and the spectra were evaluated by microphotometry. The effective concentration range for both elements was 50 to 500 ppm. Coefficients of variation for single spectra were 5% for zirconium and 8.5% for calcium at the 300 ppm level. (auth)

9684 HW-55666

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SPECTROCHEMICAL DETERMINATION OF URANIUM-235. W. G. Jolley. Apr. 9, 1958. 8p. Contract W-31-109-Eng-52. $0.50(OTS).

A method was developed for determining U^{235} in enriched fuel elements and was found to work effectively for concentrations of 0.70 to 1.5%. Limited investigations were made at higher concentrations, and results indicate that the procedure can be used with very little alteration for enrichment levels up to several per cent. Natural uranium containing 0.71% U^{235} was analyzed by this method, and the standard deviation was found to be 0.031 absolute or 4.4% relative. At a concentration of 1.01% U^{235} the standard deviation was 0.031 absolute or 3.10% relative. A Jarrell-Ash 3.4 meter grating spectrograph equipped with a camera and photographic plates was used for this study (a direct reader attachment replacing the camera would increase the accuracy by eliminating the inherent inaccuracies of density measuring instruments and the photographic plate). (auth)

9685 IDO-16402

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PROGRESS REPORT ON THE STUDY OF IRRADIATED THORIUM. R. G. Nisle and E. Fast. Aug. 28, 1957. 23p. Contract AT(10-1)-205. $0.75(OTS).

The results of improved reactivity measurements on nineteen MTR irradiated RD-1 slugs are correlated with chemical-mass spectrometer analysis results on two of these RD-1 slugs, and with delayed neutron counts. A correlation also is made between reactivity and delayed neutron counts for fifty-four slugs irradiated in the Savannah River reactor. The results indicate that the reactivity-chemical analysis correlation provides the best non-destructive means for estimating the uranium-233 content of the irradiated thorium slugs. The U^{233} content of the RD-1 slugs is estimated by this method to range between 2 and 8 g; that of the Savannah River slugs is estimated to range between 1 and 3 g. Given a sufficient number of RD-1 slugs, it is estimated that the minimum U^{233} content ought to be about 15 g per slug in order that a satisfactory exponential pile may be built. Similarly, the U^{233} content of the Savannah River slugs ought to be increased to about 10 g. (auth)

9686 ORNL-2453

Oak Ridge National Lab., Tenn.

ANALYTICAL CHEMISTRY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1957. Jan. 30, 1958. 105p. Contract W-7405-eng-26. $2.75(OTS).

At the X-10 site, research and development continued with spectrophotometric studies of Pu in sulfate systems, determination of Pu^{3+} and Pu^{4+} in PuF_3-PuF_4 mixtures in fused $NaF-BeF_2$, coulometric reduction of $KTcO_4$, fractionation of Amsco 125-82, chemical changes occurring in UO_2-Al fuel element fabrication, analysis of yttrium alloys, polarography of Nb in citric acid, spectrophotometric determination of Nb using hydroquinone, and instrumental methods for Ni and Cr in fluoride salts for use in the High-Radiation-Level Analytical Facility. Also an enthalpymetric determination of free acid in presence of certain hydrolyzable ions was developed, and analysis of gaseous nitrogen oxides was studied spectrophotometrically. In the In-Line Instrumentation Program development and testing is reported on: an interface-level controller for use with conductivity-type digital probe, an a-c polarograph for U losses in raffinate streams, a gamma activity monitor, an r-f monitor for HNO_3 in feed streams, flow-rate meters, a potentiometric Cl^- monitor for Darex Process, continuous alpha monitors, densimeters and flow colorimeter. Instruments developed and being developed by the Analytical Instrumentation Group include: a flame spectrophotometer, a simplified controlled-potential coulometric titrator, a gamma absorption photometer for determination of U and Pu in pure solutions, an automatic spectrophotometric titrator, a buret for enthalpy titrations, and a controlled-potential and derivative polarograph. Radiochemical Analyses. Electromagnetic radiation from Pu isotopes and L-shell fluorescence yields of several nuclides were studied. Other studies of interference in alpha counting by low-energy beta radiation, applications of gamma spectrometry, and analysis of noble gas mixtures for radionuclides are reported. Activation Analyses. Neutron activation analysis was applied to determination of

microgram and submicrogram amounts of many elements in various samples. Its application in particle-size-distribution analysis is discussed. Mass Spectrometry. Design and construction of a 60°, 6-in. instrument capable of simultaneous collection of 2 neighboring isotopes of mass as low as 20 is described. Enrichment of Ar^{36}, Kr^{86}, Kr^{84}, Kr^{80}, and Kr^{78} by thermal diffusion is reported. Spectrochemical and X-Ray Analyses. Studies of separation of rare earths from Al and collection of rare earths, W, Ta, Nb, and Sb by chemical means are reported. An x-ray fluorescence procedure for analysis of U–Zr–Nb was developed. The spectrographic limit of detection of Li and Cs were lowered using alcohols as solvents. Inorganic Preparations. Work continued on anhydrous transition metal halides, fused salts for solvent systems, and hexahalorhenates. Optical and Electron Microscopy. Research is reported on: ThO_2 slurry program, dispersion of agglomerated, friable particles for electron microscopy, effect of Van de Graaff generator exposure on oxide films on Zircaloy-2, 347 stainless steel, and Ti, nonconductivity of In films on Ge single crystals, and other corrosion product and surface studies. Research and development at Y-12 site continued with the HRP Analytical Chemistry Laboratory working on the improvement of methods for corrosion products in UO_2SO_4 solutions and ThO_2 slurries. Methods developed or investigated are: Zn by derivative polarograph, Ce by redox titration, As by colorimetry, Ru by flame photometry, and separation of Ru from UO_2SO_4 by pyrolysis. For ThO_2 analysis these methods were developed: Mo by colorimetry as quercetin complex, Co by colorimetry as 1-(2-pyridylazo)-2-naphthol (PAN) complex, Ti by spectrophotometry using Tiron, Al separation by solvent extraction and determination by flame photometry or colorimetry, and hydrazine distribution in ThO_2 slurries by colorimetry. Other work is reported on flame photometry of La, pyrolytic separation of fluorides, determination of sulfate by potentiometric method, and Tc estimation by polarography and beta counting. The Methods Development Group evaluated tri-n-octylphosphine oxide (TOPO) in cyclohexane as extractant for Zr, Mo, U, Bi, Th, Nb, Ta, and Ti, and colorimetric methods were developed for determination of these elements in TOPO. Other methods evaluated were: Fe in di(2-ethylhexyl)phosphoric acid, Cr after oxidation by AgO, Al by colorimetry using pyrocatechol violet, and V and Ni by spectrophotometry. The Raw Materials Group worked on determination of SO_2 in amines in n-butanol, decomposition of di(2-ethylhexyl) phosphoric acid, determination of Bi, and colorimetric estimation of phosphate in vanadium oxide. A brief summary of the quality control program of the Analytical Chemistry Division is given, and service analyses performed are summarized. (For preceding period see ORNL-2218.) (T.R.H.)

9687 RCC/M-10

Gt. Brit. Radiochemical Centre, Amersham, Bucks, England.

MEASUREMENT OF RADIUM SOLUTIONS BY DEEMANATION. G. H. C. Dancer and M. Michaelis. June 1951. Changed from OFFICIAL USE ONLY Apr. 18, 1958. 9p.

Radon was removed from radium solutions by passing air through them to sweep the radon into an ionization chamber. Alpha counts of the radon decay products thus collected were compared with known radon samples obtained from clinical "seeds." The radium content of unknown solutions can thus be determined with an accuracy of ± 5%. (auth)

9688 UCRL-5134

California. Univ., Livermore. Radiation Lab.

SIMULTANEOUS DETERMINATION OF CARBON, HYDROGEN, AND NITROGEN. Jack W. Frazer. Feb. 1958. 8p. Contract W-7405-eng-48. $0.50(OTS).

A method of simultaneous carbon, hydrogen, and nitrogen determinations in 3 to 5 mg samples of organic compounds is presented. Organic combustion products are measured as hydrogen, nitrogen, and carbon dioxide in a simple apparatus. Samples containing carbon, hydrogen, nitrogen, oxygen, halogens,and sulfur can be analyzed to the same accuracy as by conventional methods. (auth)

9689 WAPD-CDA(AD)-339

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

TEST RESULTS OF THE BETTIS HIGH-PRESSURE OXYGEN ANALYZER. J. M. Wright and T. R. Druga. [1958]. 47p. $7.80(ph OTS); $3.30(mf OTS).

A high-pressure oxygen analyzer (Bettis analyzer) for determination of oxygen to water, designed for continuous Shippingport Reactor coolant oxygen analysis, was tested. Results are presented relating to lower limit of analysis, the effect of dissolved hydrogen, flow-rate limits, the effect of the mixed-bed ion exchange resin, and comparison of the analyzer with the Beckman and Winkler analyzers. (J.E.D.)

9690 WAPD-T-670

Westinghouse Electric Corp. Bettis [Plant], Pittsburgh.

DENSITY MEASUREMENT PROBLEMS IN HOT CELLS. K. Stratton. [1958?]. 19p. $3.30(ph OTS); $2.40(mf OTS).

Presented at the Sixth Hot Lab. and Equipment Conference, March 1958, Chicago.

Problems associated with the precise determination of densities in hot cells are considered in connection with pycnometric and loss of weight in liquid methods. The latter technique involves problems of vibration and temperature control, radiation resistance of balance components, drafts and disturbances due to cell ventilation, access for maintenance, and ease of operation by master slave manipulators. The immersion of radioactive specimens in a liquid requires further consideration of radiation stability and radioinduced heating of the liquid, thermal instabilities, precise temperature measurement, and appropriate sling design. Means are presented for reducing or correcting these sources of error. A special hot cell design is described which eliminates many of these errors. (auth)

9691

A NEW RAPID METHOD FOR THE GRAVIMETRIC DETERMINATION OF BISMUTH. J. Dick and F. Mihai. Acad. rep. populare Romine Baza cercetări stiint. Timisoara Studii cercetări stiint. Ser. I, 2, 97-102 (1955). (In Romanian)

A new rapid method for the gravimetric determination of bismuth based on the precipitation of bismuth gallate and on its direct weighing is described. The insolubility of bismuth gallate in water, alcohol, ether, and acetone allows the application of the procedure to the rapid determination of the elements without calcination. The total composition of bismuth gallate is confirmed. The operation can be done in a very short time. It has a relatively great specificity, and the errors do not exceed ± 0.25%. (tr-auth)

9692

CONTRIBUTION TO THE COLORIMETRIC DETERMINATION OF POTASSIUM. Z. Steiner. Acad. rep. populare Romine Baza cercetări stiint. Timisoara

Studii cercetări stiint. Ser. I, 2, 165-9(1955). (In Romanian)

The alcoholic solution of 1% naphthylamine in an acid medium is a sensitive color reagent for the determination of the NO_2 group from the cobaltihexanitrite of potassium or sodium and can be used for the quantitative colorimetric determination of potassium. The limits within which the coloration produced follows the Lambert–Beer Law are 60 to 240 γ $NaNO_2$, corresponding to 16 to 64 γ of potassium. The formula $K_2Na(CoNO_2)_6 \cdot H_2O$ is confirmed for the precipitate produced by the present colorimetric method. The preliminary tests, made with the aid of biological liquids, indicate the possibility of a useful application of the method to the determination of potassium in human and animal serum. The minimum quantity of potassium determinable by this method is of the order 10^2 γ, a value which corresponds to the potassium content of $\frac{1}{2}$ to 1 cm^3 of human serum. The colorimetric reaction produced with naphthylamine becomes, after approximately $\frac{1}{2}$ hr, intense and stable for a long time. (tr-auth)

9693

RADIOCHEMICAL DETERMINATION OF IONIUM IN URANIUM FLUORINATION ASH. Fletcher L. Moore (Oak Ridge National Lab., Tenn.). Anal. Chem. 30, 1020-1(1958) June.

A carrier-free method for the determination of ionium (thorium-230) in process solutions of uranium fluorination ash is described. Ionium is carried on lanthanum hydroxide and lanthanum fluoride and extracted with 0.5M 2-thenoyltrifluoroacetone–xylene to effect high selectivity. The technique gives satisfactory results when applied to process solutions. Yields average 97 ± 3%. The method may be used to determine ionium in the presence of all other alpha emitters. (auth)

9694

DETECTION OF THORIUM AND URANIUM. James S. Fritz and Evelin Carlston Bradford (Iowa State Coll., Ames). Anal. Chem. 30, 1021-2(1958) June.

Simple qualitative tests for thorium(IV) and uranium(VI) are proposed, based on color reactions with the reagent arsenazo. EDTA is first added to mask foreign metal ions. Uranium(VI) is separated from thorium(IV) by extracting uranyl diethyldithiocarbamate into benzene. (auth)

9695

GAMMA SPECTROMETRIC AND RADIOCHEMICAL ANALYSIS FOR IMPURITIES IN ULTRAPURE SILICON. Barbara A. Thompson, Barbara M. Strause, and Maurice B. Leboeuf (General Electric Co., Schenectady, N. Y.). Anal. Chem. 30, 1023-7(1958) June.

Methods have been developed to determine many impurities in a single sample of transistor-grade silicon by neutron activation analysis. The methods utilize both gamma spectrometry and radiochemical separations with beta counting. Their applicability to the determination of specific elements is discussed and detection limits, in the part per billion range in most cases, are presented for some 29 elements. Advantages and disadvantages of different neutron sources are discussed. Measurements of short-lived impurities are described and evaluated. For many of the elements of greatest interest in transistor production, activation analysis seems to be the best available analytical method that can be applied effectively on a semiroutine basis. (auth)

9696

DETERMINATION OF TRACES OF URANIUM WITH 1-(2-PYRIDYLAZO)-2-NAPHTHOL. K. L. Cheng (Westinghouse Electric Corp., East Pittsburgh). Anal. Chem. 30, 1027-30(1958) June.

1-(2-Pyridylazo)-2-naphthol reacts with many polyvalent metals, forming intensely colored complexes. However, in the presence of strong complexing agents, such as (ethylenedinitrilo)tetraacetic acid and cyanide, it reacts only with uranium to form a deep red finely divided precipitate in ammoniacal solutions. The naphthol complex can be extracted by o-dichlorobenzene and has its maximum absorption at 570 mμ. The color is stable and follows Beer's law over the range of 0.1 to 5×10^{-4} mmole of uranium in 10 ml of the solvent. The molar absorptivity of 1-(2-pyridylazo)-2-naphthol is 23,000; therefore, it may be the most sensitive color reagent for uranium. Trace amounts of uranium may be determined in the presence of many metals without prior separation. (auth)

9697

DETERMINATION OF TOTAL FLUORIDE CONTENT IN URANIUM TETRAFLUORIDE USING ION EXCHANGE COLUMNS. K. F. Sporek (Eldorado Mining and Refining, Ltd., Ottawa). Anal. Chem. 30, 1030-2(1958) June.

A simple and rapid method for the determination of total fluoride content in uranium tetrafluoride is based on separation of the fluoride ion by means of a cationic ion exchange resin and titration of the liberated hydrofluoric acid with sodium hydroxide. The solid sample of uranium tetrafluoride is dissolved in a mixture of sodium hydroxide and hydrogen peroxide and after dilution the solution is passed through the ion exchange column. The above mixture of reagents is also suitable for dissolving UO_2, U_3O_8, UO_3, and UO_2F_2, all of which may be present in lesser or larger amounts in technical uranium tetrafluoride. A determination requires only 15 to 20 minutes and no complicated or expensive apparatus is needed. The standard deviation for 15 determinations was ±0.13 on a value of 23.91% fluorine. (auth)

9698

COMPLEXOMETRIC DETERMINATION OF SULFATE. K. F. Sporek (Eldorado Mining and Refining, Ltd., Ottawa). Anal. Chem. 30, 1032-5(1958) June.

A simple and rapid method for the determination of sulfate in materials obtained during extraction of uranium from ores is based on precipitation as lead sulfate from acid solution containing isopropyl alcohol. The precipitate is filtered and redissolved in an excess of measured standard (ethylenedinitrilo)tetraacetic acid (EDTA) solution. The excess of the latter is then back-titrated with a standard zinc chloride solution and Eriochrome Black T as indicator. A detailed study of the optimum conditions for the precipitation of lead sulfate has been carried out, and the degrees of interference of phosphate, arsenate, iron, and uranium ions have been tested. The method is virtually free of interferences and gives accurate results in the range 0.1 to 100% sulfate; the time required for a determination is about 30 to 45 minutes. (auth)

9699

DETERMINATION OF CATALYST WATER BY EXCHANGE WITH DEUTERIUM GAS. James K. Lee and Sol W. Weller (Houdry Process Corp., Linwood, Penna.). Anal. Chem. 30, 1057-8(1958) June.

A method of determining water (or its equivalent as hydroxyl) in oxide catalysts is based on the isotopic exchange of hydrogen in the water with gaseous deuterium at 500°C. The method is nondestructive, by contrast with the ignition loss method, and it compares with the latter in accuracy. Another advantage over ignition loss

is the absence of interference from volatile components other than water. (auth)

9700

DETERMINATION OF ZIRCONIUM IN TITANIUM ALLOYS USING p-BROMO- OR p-CHLOROMANDELIC ACID. Roland A. Papucci (F. C. Boreman and Co., Cincinnati) and Joseph J. Klingenberg (Xavier Univ., Cincinnati). Anal. Chem. 30, 1062–4(1958) June.

Zirconium has found application as an alloying element in titanium. Zirconium in amounts from 0.1 to 10.0% can be successfully determined in commercial titanium alloys by the halomandelate procedure using p-bromo- or p-chloromandelic acid as reagent. (auth)

9701

COULOMETRIC TITRATIONS WITH MERCURY(I) AND (II). DETERMINATION OF SULFIDE. Edwin P. Przybylowicz and L. B. Rogers (Massachusetts Inst. of Tech., Cambridge). Anal. Chem. 30, 1064-9(1958) June.

The coulometric determination of sulfide was undertaken because the extremely low solubility product reported for mercury(II) sulfide appeared to offer an excellent means for testing the ultimate sensitivity of coulometry. Mercury(II) could be generated in alkaline solution at 100% efficiency by using mercury-coated gold electrodes. By titrating at 80°C, effects attributed to adsorption could be minimized. Amounts from 0.24 to 1.11 mg were determined in 100 ml of solution with an error of about ±0.2%; amounts down to 0.060 mg, with an increasing error up to 2%. The lower limit of the determination was probably set by the grid-current of the continuous-indicating potentiometer as evidenced by behavior in the end point region characteristic of a polarized system. (auth)

9702

EVALUATION OF INERT GAS FUSION METHOD FOR RAPID DETERMINATION OF OXYGEN IN STEEL. John I. Peterson, Florence A. Melnick, and John E. Steers, Jr. (Jones & Laughlin Steel Corp., Pittsburgh). Anal. Chem. 30, 1086-9(1958) June.

The inert gas fusion method has been improved and evaluated for use as a rapid method of determining oxygen in steel samples. The method has been tested by comparison with the vacuum fusion method on a variety of steels. It permits a determination of oxygen in most steels in 7 minutes or less. Most of the advantages of vacuum fusion are retained in the method, yet a considerable simplification in apparatus and its operation is gained. The analyses are in agreement with those obtained by vacuum fusion. (auth)

9703

CHELOMETRIC TITRATIONS USING AN AZOARSONIC ACID INDICATOR. James S. Fritz, Richard T. Oliver, and Donald J. Pietrzyk (Iowa State Coll., Ames). Anal. Chem. 30, 1111-14(1958) June.

Arsenazo [3-(2-arsonophenylazo)-4,5-dihydroxy-2,7-naphthalenedisulfonic acid, trisodium salt] is an excellent indicator for the EDTA titration of rare earths and yttrium in weakly acid solution. In many cases, use of masking agents or a simple preliminary separation permits determination of rare earths in samples containing foreign metal ions. Aluminum is masked by sulfosalicylate, and interference from calcium and magnesium is avoided by proper pH control. Small amounts of uranium, iron, and most divalent metals are masked by diethyldithiocarbomate; larger amounts of these metals are removed by extraction of their diethyldithiocarbamate complexes. Thorium interferes with the titration of rare earths, but can be titrated at a more acidic pH. Titration of thorium in the presence of uranium is possible. (auth)

9704

DETERMINATION OF FLUORIDE ION BY TURBIDIMETRIC TITRATION. Warren W. Brandt and Allen A. Duswalt, Jr. (Purdue Univ., Lafayette, Ind.). Anal. Chem. 30, 1120-2(1958) June.

Milligram quantities of fluoride may be determined by a rapid, convenient method using a turbidimetric titration. The simple apparatus is easily and quickly assembled from materials that are generally available. It permits the use of cells varying in size from glass tubing 1 cm in diameter to large beakers, depending upon the volume of solution and type of precipitate obtained. With calcium ion as the titrant, concentrations of 0.01 to 0.09M fluoride ion may be determined with an average relative error of ±2%. Thorium ion may be used as the titrant to determine fluoride ion from 0.04 to 1.0M, with an average relative error of ±2%. As little as 0.4 mg of fluoride ion in 2 ml of solution may be determined with a relative error of ±4%. The time for a single determination is generally less than 10 minutes. (auth)

9705

DETERMINATION OF TITANIUM IN PRESENCE OF NIOBIUM BY DIFFERENTIAL SPECTROPHOTOMETRY. Rodrigo A. Guedes de Carvalho (Laboratorios KUDI, Rua Miguel Bombarda, 199, Porto, Portugal). Anal. Chem. 30, 1124-7(1958) June.

Titanium can be determined in mixed tantalite–columbite–ilmenite ores without prior separation of niobium. A reliable correction for niobium is made without determining the amount actually present. Application of the differential spectrophotometric method increases precision. (auth)

9706

DITHIZONE METHOD FOR DETERMINATION OF LEAD IN MONAZITE. R. A. Powell and C. A. Kinser (U. S. Geological Survey, Washington). Anal. Chem. 30, 1139-41(1958) June.

In the determination of lead in monazite—to be used as the basis for geologic age measurements—it was necessary to eliminate interferences due to the presence of phosphates of thorium and the rare earth metals. The method involves attacking the monazite samples with hot, concentrated sulfuric acid, then taking them up with dilute nitric acid. Lead is extracted as the dithizonate and determined spectrophotometrically at 520 mμ. Rapid determinations were made with good reproducibility on a series of monazite samples. (auth)

9707

BETA RADIATION OF THE AMNIOTIC FLUID IN MAN. A. I. Danilenko (Bofomolets Inst. of Physiology, Academy of Sciences, Ukrainian SSR). Byull. Eksptl'. Biol Med. No. 3, 68-70(1957) Mar.

The natural radioactivity was determined for amniotic fluid from nineteen specimens of female fetus and fourteen specimens of male fetus. The radioactivity of the females was nearly double that of the males. (C.H.)

9708

DETERMINATION OF URANIUM USING DISODIUM 1:8-DIHYDROXYNAPHTHALENE-3:6-DISULPHONATE (CHROMOTROPIC SALT) AS A COLORIMETRIC REAGENT. Anil K. Mukherji and Arun K. Dey (Univ. of Allahabad, India). J. Indian Chem. Soc. 35, 113-18 (1958) Feb.

The use of disodium 1,8-dihydroxynaphthalene-3,6-disulfonate (chromotropic salt) as a reagent for the de-

termination of uranium on a micro-scale is described. The reagent is sensitive to 30 ppm of uranium, and Beer's law holds good in the range of concentration of 50 to 200 ppm. The reagent added should be at least 30 times the molar concentration of uranium. The pH of the medium should be adjusted at 4.00 ± 0.50. For the determination, either a photoelectric colorimeter with a blue filter or a spectrophotometer can be employed. The interference of various cations and anions has also been studied. The chelate has a composition of 1:1 of the reactants. (auth)

9709

MEASUREMENT OF THE ABSORPTION SPECTRA OF NEPTUNIUM IONS IN HEAVY WATER SOLUTION FROM 0.35 TO 1.85μ. W. C. Waggener (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 62, 382-3(1958) Mar.

The spectra of neptunium ions in heavy water solution in the range from 1.2 to 1.8 microns were studied. Spectral curves were recorded for neptunium VI, V IV, and III ions in the deuterated medium during reduction. (J.R.D.)

9710

COMPOSITE PROCEDURE FOR THE DETERMINATION OF Mo, Ni, Mn, Fe, Cr, Sn, V AND N IN TITANIUM ALLOYS. George Norwitz and Maurice Codell (Frankford Arsenal, Philadelphia). Metallurgia 57, 261-7, 269-70(1958) May.

A composite procedure is proposed for the determination of eight elements in titanium alloys, Molybdenum is determined colorimetrically with thiocyanate or gravimetrically or volumetrically after a sulfide precipitation. Nickel is determined colorimetrically or gravimetrically with dimethylglyoxime. Manganese is determined by the periodate colorimetric method, or by titration with arsenite. Iron is determined colorimetrically with ortho-phenanthroline, or by titration with dichromate. Chromium is determined colorimetrically with diphenylcarbazide, or by titration with ferrous sulfate. Tin is determined iodometrically. Vanadium is determined by titration with ferrous sulfate, using sodium diphenylbenzidine sulfonate indicator. Nitrogen is determined volumetrically after distillation. (auth)

9711

SPECTRAL ANALYSIS BY THE EVAPORATION METHOD. V. ANALYSIS OF PLUTONIUM BY THE METHOD OF EVAPORATION IN VACUUM. A. N. Zaydel', N. I. Kaliteyevskiy, L. V. Lipis, and V. M. Tarakanov. Optika i Spektroskopiya 3, 16-20(1957).

A technique was developed for the application of the evaporation method to the spectral analysis of plutonium. The spectrum of plutonium was obtained by depositing a drop of plutonium chloride on a copper electrode and evaporating it slowly to obtain a layer of plutonium oxychloride. The spectrum was excited in argon at 500 mm Hg, and the spectrum in the region 2000 to 6500 A was obtained. The spectrum indicated that determination of calcium, titanium, tungsten, molybdenum, and aluminum with a sensitivity of 0.005 to 0.01% was possible. It was found that PuO_2 was the best substance to use for the spectral analysis provided it was not heated above 1800°C. In the standards PuO_2 could be replaced by ThO_2. With ThO_2 standards Na, K, Li, Mn, Si, B, Co, Cd, and Ag impurities in Pu could be determined quantitatively. (J.S.R.)

9712

SPECTRAL-ISOTOPIC METHOD FOR THE DETERMINATION OF HYDROGEN IN METALS. A. N. Zaidel (Leningrad State Univ., USSR). Spectrochim. Acta 10, 369-76(1958) Feb.

An isotopic exchange method of hydrogen determination is presented in which the hydrogen in the metal sample is allowed to come to equilibrium with deuterium introduced to the system; the isotopic composition of the gas is then determined by spectroscopic analysis. (J.R.D.)

9713

SPECTROGRAPHIC ANALYSIS OF ORES BY INTRODUCING THE POWDER INTO THE ARC IN A STREAM OF AIR. A. K. Rusanov and V. G. Khitrov (Inst. of Applied Mineralogy, Moscow). Spectrochim. Acta 10, 404-18(1958) Feb.

A new method is presented for the spectrographic analysis of substances in powder form, using an alternating current arc, which is initiated by a high frequency discharge. The powder, carried in a stream of air, is introduced evenly into the discharge zone of a horizontal carbon or metallic arc. The air stream also stabilizes the arc. The introduction of the material in a stream of air prevents reactions which normally occur on the electrodes, prevents the fractional evaporation of the different elements, and ensures their uniform entry into the discharge zone and uniform conditions of excitation. The excitation conditions depend very little on the compositions of the electrodes, and are mainly determined by the ionization potentials of the elements in the powder blown in. This technique gives a significant increase in sensitivity and reproducibility, and reduces the time required for analysis. It offers great possibilities for direct photoelectric measurement of line intensities because the radiation remains constant. (auth)

Crystallography and Crystal Structure

9714 CF-58-3-15

Oak Ridge National Lab., Tenn.

THE CRYSTAL STRUCTURES OF 7:6 TYPE COMPOUNDS OF ALKALI FLUORIDES WITH URANIUM TETRAFLUORIDE. L. A. Harris. Mar. 6, 1958. 3p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

Initial crystal-structure determinations were made for some 7:6 type compounds of lithium, potassium, sodium, and rubidium with uranium tetrafluoride. (J.R.D.)

9715

THE UNIT CELL AND SPACE GROUP OF THORIUM tetrakis-DIBENZOYLMETHANE. E. Wait and A. E. Comyns (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Acta Cryst. 11, Pt. 4, 301(1958) Apr. 10.

The preparation of thorium tetrakis-dibenzoylmethane (I) has been described elsewhere (Comyns, 1957). It crystallized from toluene as pale yellow orthorhombic tablets showing straight extinction between crossed Nicols: elongated [001], tabular {100}. The density was determined by flotation in aqueous K_2HgI_4. Oscillation photographs, and zero-, first-, and second-layer equi-inclination Weissenberg photographs taken about the c axis confirmed the orthorhombic symmetry. Cu Kα radiation (λ = 1.542 A) was used. The cell-dimensions were: a = 20.4 ± 0.1, b = 10.33 ± 0.05, c = 23.2 ± 0.1 A. The calculated density, assuming 4 molecules per unit

cell, is 1.53 ± 0.01 g.cm^{-3}; the experimental value was 1.52 g.cm^{-3}. The following classes of reflection were observed to be systematically absent: 0kl, l ± 2n; h0l, l ± 2n; hko, h + k ± 2n. Also, all reflections hkl with l ± 2n were observed to be weak. The space group is thus Pccn and the thorium atoms lie in the fourfold special positions (d) or (c), these differing only in the choice of origin. The point symmetry of these positions is 2, and the molecules therefore each possess a twofold axis. This sheds little light on the stereochemistry of eight-fold coördination (Marchi, Fernelius & McReynolds, 1943; Nyholm, 1954), since most of the possible models have twofold axes. (Entirety)

9716

THE K_2NiF_4 STRUCTURE OF La_2NiO_4. A. Rabenau and P. Eckerlin (Zentrallaboratorium der Allgemeinen Deutsche Philips Industrie, G.m.b.H., Laboratorium, Aachen). Acta Cryst. 11, Pt. 4, 304-6(1958) Apr. 10. (In German)

Deuterium and Deuterium Compounds

9717

ON THE ISOTOPIC EXCHANGE BETWEEN GASEOUS HYDROGEN AND SOLID POLYMERS UNDER THE ACTION OF NUCLEAR RADIATION. Ya. M. Varshavskii, G. Ya. Vasil'ev, V. L. Karpov, Yu. S. Lazurkin, and I. Ya. Petrov. Doklady Akad. Nauk S.S.S.R. 118, 315-16 (1958) Jan. 11. (In Russian)

An attempt was made to determine the possibility of the exchange of gaseous hydrogen with polymer molecules under irradiation. The isotopic exchange between the hydrogen and reactor-irradiated solid polymers (polyethylene, polypropylene, polystyrene, butadiene rubber, and polymethylmethacrylate) was investigated with deuterium as a tracer. A table of the actual concentration of deuterium absorbed by irradiated polymers is included. (R.V.J.)

9718

DIFFUSION AND SELF DIFFUSION IN AQUEOUS SOLUTIONS OF SUCROSE AND MIXTURES OF H_2O-D_2O. Arthur W. Adamson and Riyad Irani (Univ. of Southern California, Los Angeles). J. chim. phys. 55, 102-9 (1958) Feb. (In French)

The coefficient of mutual diffusion and the two coefficients of self-diffusion of aqueous solutions of sucrose from 0 to 2.5 M were measured at 25°C. The results indicate that the self-diffusion is caused, in part, by the water–water and sucrose–sucrose exchange, and also to the water–sucrose exchange which contributes, at the same time, to the self-diffusion and the mutual diffusion. The tests on the movement of the stable or marked particles have given supplementary proof of the nature "at a short distance" of the coupling between the three types of molecular movement. The actual theories of coupled diffusion are briefly discussed, and another theory based on the theory of absolute velocities is suggested. The coefficients of diffusion of O^{18} and of hydrogen are given at 25°C for the whole scale of H_2O-D_2O mixtures. It is interesting to note that when the diffusion of O^{18} varies in a direction opposite to the viscosity of the mixture, that of the hydrogen shows a pronounced minimum for 50% D_2O. This is interpreted by the existence of distinct mechanisms for the movements of oxygen and hydrogen, with different exchange phenomena between the groups of water molecules. (tr-auth)

9719

THE DENSITIES OF HEAVY WATER LIQUID AND SATURATED VAPOR AT ELEVATED TEMPERATURES. G. M. Hebert, H. F. McDuffie, and C. H. Secoy (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 62, 431-3(1958) Apr.

The densities of the liquid and saturated vapor of heavy water at 175 to 371°C have been calculated from experiments on the concentration, temperature, and fractional filling of sealed quartz tubes. The determinations were also made for light water, and the method appears adaptable for use with other liquids such as pure hydrocarbons. (J.R.D.)

Fluorine and Fluorine Compounds

Refer also to abstracts 9704, 9730, 10231, 10232, and 10234.

9720 GAT-P-11

CONCERNING A NEW REACTION OF CHLORINE DIOXIDE. THE FORMATION OF A COMPOUND WITH THE FORMULA ClO_2F. H. Schmitz and H. J. Schumacher. Translated by J. R. Arndt and J. W. Whisler from Z. anorg. allgem. Chem. 249, 238-44(1942). 7p.

From gaseous ClO_2 and F_2, it is possible to prepare a compound of the formula ClO_2F, provided that proper conditions are maintained such as a ClO_2 pressure of 25 mm or less, an F_2 pressure of approximately 50 mm and diluted with the addition of several hundred mm of inert gas to a total pressure of one atmosphere. ClO_2F is a colorless gas at ordinary temperatures. The boiling point of the colorless liquid is −6°C. It solidifies at approximately −115°C into a white crystalline mass. The vapor pressure was measured in the range of −80 to −6°C. From these data, the average molar heat of vaporization was calculated to be 6.2 kcal. Trouton's constant was 23.2. The compound is highly reactive with water. Even moist air reacts to form a thick, white cloud. It may be stored relatively well in a dry quartz vessel. With respect to the effects of heat, however, it is much less reactive than chlorine dioxide. (auth)

9721

PREPARATION OF BERYLLIUM FLUORIDE FROM BERYLLIA. K. R. Hyde, D. J. O'Connor, and E. Wait (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. and Nuclear Chem. 6, 14-18 (1958) Feb.

The preparation of beryllium fluoride from two samples of beryllia (calcined at 500 and 1400°C) by treatment with anhydrous hydrogen fluoride has been studied in relation to temperature and time of reaction. The optimum temperature is about 220°C, and the amount converted, which may be as high as 98.4 per cent, does not increase appreciably after 1 hr. X-ray analysis has given no evidence for solid solution formation between BeF_2 and unreacted BeO. (auth)

Graphite

Refer also to abstract 10173.

9722 AERE-CE/M-220

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

CARBONIZATION AND GRAPHITIZATION OF POLYMERIC AND RELATED MATERIALS. A SURVEY OF THE LITERATURE. G. Boocock and S. D. Holdsworth. Dec. 1957. 20p. (HRGP/P-72).

The literature is surveyed to evaluate materials which might be used as binders or fillers in the preparation of reactor-grade graphite. Coal products, polymers, polysaccharides, dyestuffs, and some aromatic compounds are considered for their physical properties upon charring. (T.R.H.)

9723 NP-6706

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

GRAPHITE TECHNOLOGY. Progress Report No. 6 for the period February 1, 1958 to April 1, 1958. S. W. Bradstreet. Apr. 1, 1958. 90p. Appendix: DIFFERENTIAL THERMAL ANALYSIS OF CARBONS CONTAINING PITCH AND RESIN BINDERS. H. Henry Nakamura and Leon M. Atlas. 19p. Project No. G-033. Contract AF33(616)-5185.

A sufficient number of carefully prepared specimens of the arbitrary "standard" pitch-bonded coke mix have now been made and carbonized to permit selection of the optimum proportions of each and proper mixing, molding, carbonizing, and measuring methods. These were tested sufficiently to show that most of the variability in properties (density, electrical resistivity, flexural strength, dynamic modulus) arises from changes in binder rheology and from local variations in the rapidity of the coking mechanism. It is nevertheless possible to establish confidence levels, in laboratory production of small molded specimens, of approximately 99% for the green state and 95% for the carbonized state (except, of course, in flexural strength values). Highest reproducibility is attained when the mix is carefully desolvated before molding, but best properties were achieved with mixes in which some aging of the pitch had occurred. The increase in green and carbonized densities with time of aging at 125°C was found to be linear. The carbonizing cycle for pitch-bonded structures which, without being unduly long, produces good reproducible density and strength in pitch-bonded coke specimens is one which provides relatively slow heating in the range 450 to 550°C. As a result of density measurements and mercury porosimetry, furfuryl alcohol monomer has been chosen as the synthetic resin to be used in later studies. Its advantages over phenolic resins and molding powders is demonstrable in the high real density of the coke bridges formed by it, and by the low variations in coke bodies bonded with it. The completion of allowed binder studies using differential thermal analysis shows that this technique gives rapid and valid testimony regarding those properties of the binder pertinent to its role in carbon technology. Measurements of the properties of a molded commercial graphite were made, primarily to refine high-temperature measuring techniques. These indicate that macro-stresses exist in large specimens which are partially relieved by a single thermal cycle to above 2500°C in the specimens cut from it; the relief is attended by permanent increase in the specimen length and decrease in its room-temperature dynamic modulus and electrical resistivity. Specimens having unusual anisotropies were easily detected by unusual ratios of modulus, resistivity, and water absorption to their density. Listed in the report are the unusual relations obtained when dynamic flexural modulus was measured as a function of temperature to above 2600°C. These show the "creep threshold" temperature increases with continued thermal cycling to a limiting value near 2500°C; the change appears to be associated with crystallite growth and reorientation. (For preceding period see NP-6622.) (auth)

9724

A CHEMICAL MODEL OF RADIATION DAMAGE IN GRAPHITE. G. R. Hennig (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 514-28(1958) May.

It is shown that the production rate of electron traps during fast neutron bombardment of graphite can be determined by comparing its properties with those of chemically doped graphite. A value of 9×10^{-5} trap per equivalent megawatt day unit of reactor bombardment is obtained. This comparison also shows how the scattering of the carriers is affected by bombardment. The validity of the conclusions which are reached depends upon certain assumptions concerning anisotropy and heterogeneity, which are explored in rather considerable detail. (auth)

Laboratories and Equipment

Refer also to abstract 10246.

9725 IDO-14434

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REMOTE ANALYTICAL FACILITY OPERATIONAL EXPERIENCES. George A. Huff. Apr. 4, 1958. 10p. Contract AT(10-1)-205. $0.50(OTS).

The benefits and operational experiences of the Remote Analytical Facility at the Idaho Chemical Processing Plant are described. A comparison is made of the original remote laboratory to the new Remote Analytical Facility which was described in Analytical Chemistry, Vol. 28, page 1084, July, 1956. It is shown that simple remote handling techniques are at time overlooked in preference to those which are more complex. It is pointed out that the new facility adequately fills its need. Advantages afforded by the new facility are discussed. Time required for direct and remote techniques of analysis are pointed out. Precision on methods where remote handling techniques are used is compared to precision obtained by using direct bench top techniques. (auth)

9726 ORNL-2504

Oak Ridge National Lab., Tenn.

DEVELOPMENTS IN CONTINUOUS ION EXCHANGE EQUIPMENT FOR AEC APPLICATIONS. J. T. Roberts. June 9, 1958. 45p. Contract W-7405-eng-26. $1.25(OTS).

Operational aspects of fixed-bed and continuous-countercurrent ion exchange are discussed, and several types of continuous ion exchange contactors are described. The ORNL-Higgins contactor is described in detail. (auth)

9727 TID-7014

Division of Construction and Supply, AEC.

AEC HOT CELLS AND RELATED FACILITIES. Ellery R. Fosdick. May 1958. 108p. $1.75(OTS).

Shielded enclosures equipped with viewing devices and remote-handling equipment for use in experiments and processes involving radioactivity are referred to as hot cells. The hot cell includes the biological shield enclosing the working space, viewing devices, special ventilating equipment, and special equipment for use in the hot cells, such as manipulators, cranes, machine

tools, and measuring devices. A hot cave is the same as a hot cell. A junior hot cave is a small-sized hot cave. A summary is presented of pertinent data on hot cells in use at various AEC installations. (C.H.)

9728 UCRL-3817
California. Univ., Berkeley. Radiation Lab.
A THEORY FOR INDUSTRIAL GAS-LIQUID CHROMATOGRAPHIC COLUMNS (thesis). Robert Henry Houston. Sept. 1957. 171p. Contract W-7405-eng-48. $3.00(OTS).

A theory of elution chromatography is proposed for the design of large-size chromatographic columns. In this theory, an equilibrium linear isotherm is assumed to be the mass-transfer mechanism, and dispersion of the solute band is attributed to longitudinal diffusion. The theory was tested with a small-size gas-liquid chromatographic column. The tests were conducted with a column pressure of approximately 100 psig, at various temperatures, and the Reynolds number was varied from 0.2 to 1.8. Results showed that the solute isotherms were dependent chiefly on temperature and slightly on concentration. The isotherms were independent of flow rate. The effective longitudinal diffusivity was dependent on the flow rate and size of solute sample. The Peclet number decreased from 0.11 to 0.06 with increasing flow (using benzene) and also decreased from 0.16 to 0.06 when sample size was varied from 0.6 to 6.3 micromoles of solute (using toluene). (auth)

9729 NP-tr-74
CALCULATION AND DESIGN OF CYCLONE SEPARATORS ON THE BASIS OF RECENT RESEARCHES. Walter Barth. Translated from Brennstoff-Wärme-Kraft 8, No. 1, 1-9(1956). 20p.

A calculation technique was developed with the aid of simplifying assumptions on the flow behavior in cyclone separators which allows statements to be made on the relationships between pressure loss, separation performance, and the geometrical dimensions of the cyclone separator. With the help of this calculation technique, conclusions were drawn on the suitable design of cyclone separators with regard to separation performance and economy, and definite types proposed for various situations. By means of an appropriate design an improvement in cyclone dust precipitator plants can often be achieved. (auth)

Molecular Structure

9730
THE STRUCTURE OF LIQUID ANTIMONY PENTAFLUORIDE. Charles J. Hoffman, Bert E. Holder, and William L. Jolly (Univ. of California, Livermore). J. Phys. Chem. 62, 364-6(1958) Mar.

The fluorine nuclear magnetic resonance spectrum of the compound was examined to determine the molecular structure. (J.R.D.)

9731
POSSIBLE BORON HYDRIDE IONS. William N. Lipscomb (Univ. of Minnesota, Minneapolis). J. Phys. Chem. 62, 381-2(1958) Mar.

The present form of the topological theory of boron hydrides by Dickerson and Lipscomb is extended to include ions. It is pointed out that evidence for boron hydride fragments suggests that additional experimental work is desirable. A list of the more stable ions is presented, and it is suggested that purely ionic hydrides might be prepared by reactions of salts of these ions with one another. (J.R.D.)

Radiation Chemistry

9732 BNL-3039
Brookhaven National Lab., Upton, N. Y.; and Shell Oil Co., New York.
NEUTRON IRRADIATION OF BENZENE AND OF TOLUENE IN 2-METHYLPYRAZINE. AN INVESTIGATION OF SYNTHESIS VERSUS RE-ENTRY. Alfred P. Wolf, Benjamin Gordon, and Carol S. Redvanly. [1957?]. 2p. $1.80(ph OTS); $1.80(mf OTS).

9733
CHEMICAL EFFECTS IN FISSION PRODUCT RECOIL. II. THE DECOMPOSITION OF URANYL IODATE. D. Hall (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. and Nuclear Chem. 6, 3-11(1958) Feb.

Under pile irradiation uranyl iodate decomposes, elementary iodine being formed. The amount of decomposition is proportional to the number of fissions that occur; the G factor is 5.8 iodine atoms per 100 ev of recoil energy absorbed. A constant proportion (14 per cent) of the I^{131} formed in fission is extracted with the reduced iodine, irrespective of the extent of decomposition. This is interpreted as the result of the chemical reaction involving the primary fission fragment and its surroundings. (auth)

Radiation Effects

Refer also to abstract 9724.

9734 NAA-SR-2046
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
DYNAMIC CORROSION IN POLYPHENYLS UNDER IRRADIATION. H. E. Kline, N. J. Gioseffi, and W. N. Bley. May 15, 1958. 29p. Contract AT(04-3)-88. $1.00(OTS).

Corrosion specimens of various materials were exposed to polyphenyls in the NAA-20 loops at MTR, and compared with out-of-pile specimens in the same coolant streams over the temperature range of 500° to 650°F. Aluminum, 304 and 410 stainless steel, carbon steel, and 4130 alloy steel exhibited good to excellent resistance. Magnesium and zirconium were unsatisfactory. Integrated neutron fluxes of the order of 2×10^{19} thermal, and 10^{18} fast, did not affect the corrosion resistance of the materials studied. (auth)

9735
INVESTIGATION OF THE EFFECT OF IONIZING RADIATION ON QUARTZ BY THE METHOD OF ELECTRON PARAMAGNETIC RESONANCE. Yu. N. Molin and V. V. Voevodskii (Inst. of Chem. Physics, Moscow). Zhur. Tekh. Fiz. 28, 143-9(1958) Jan. (In Russian)

The changes of electron paramagnetic resonance in molten quartz irradiated by γ rays and in crystalline quartz irradiated by γ rays and neutrons were investigated. Two types of paramagnetic defects were found in the molten quartz. The accumulations of these defects with the increased doses of irradiation and their behavior with the increased heating were studied. The nature of paramagnetic centers is discussed. (tr-auth)

9736
EFFECTS OF ELECTRON BOMBARDMENT ON SODIUM CHLORIDE FILMS. A. Gel'berg and N. Kroitoru (Inst. of Nuclear Physics, Academy of Rumanian Popular Republic, Bucharest). Zhur. Tekh. Fiz. 28, 755-8(1955) Apr. (In Russian)

Metallographic and electron microscopic studies were made of NaCl surfaces bombarded by electrons. It was found that the electron bombardment alters the structure of the NaCl film. (tr-auth)

Rare Earths and Rare-earth Compounds

Refer also to abstracts 9658 and 9716.

9737 AFOSR-TN-58-382
Ohio State Univ. Research Foundation, Columbus.
RARE EARTH OXIDES. PART II. THE VAPORIZATION OF LANTHANUM SESQUIOXIDE, La_2O_3, AND YTTRIUM SESQUIOXIDE, Y_2O_3; DISSOCIATION ENERGIES OF LaO, YO, AND TaO. Technical Note No. 2. Patrick N. Walsh and David White. Feb. 1958. 22p. Project No. 77520. Contract AF-18(600)-1545. (AD-154289).

The vaporization of La_2O_3 and Y_2O_3 from tungsten and tantalum refractories has been studied by the Knudsen effusion method in the temperature ranges 2000 to 2450°K and 2000 to 2700°K, respectively. The sesquioxides decompose to the corresponding monoxides and oxygen on vaporization from tungsten cells. The dissociation energies of the monoxides are $D_0^0(LaO) = 8.02 \pm 0.17$ e.v., and $D_0^0(YO) = 7.25 \pm 0.3$ e.v. LaO(g) and TaO(g) are the principal products formed in the vaporization of La_2O_3 from a tantalum effusion cell. Y_2O_3 also reacts with tantalum, yielding a mixture of YO(g), Y(g), and TaO(g). From the determination of the heats of these reactions, the dissociation energy of TaO(g) is found to be $D_0^0(TaO) = 9.34 \pm 0.06$ e.v. A method is described for deriving equilibrium concentrations and heats of formation from Knudsen effusion data when more than one reaction occurs in the Knudsen cell. (auth)

9738
INTRAMOLECULAR ENERGY TRANSFER IN YTTERBIUM ORGANIC CHELATES. G. A. Crosby and M. Kasha (Florida State Univ., Tallahassee). Spectrochim. Acta 10, 377-82(1958) Feb.

The $^2F_{5/2} \rightarrow {}^2F_{7/2}$ intra-multiplet transition has been observed as a luminescence emission in the tris-dibenzoylmethane-Yb^{3+} chelate. A single strong luminescence line was recorded at 9710 ± 40 Å upon excitation of the broad π,π^* absorption band of the chelate with 3650 Å light. The transition frequency agrees well with earlier observations on the unique intra-multiplet transition of Yb^{3+}. The intramolecular energy transfer is unusual in that the apparent electronic energy difference between the initial and final states is over 10,000 cm^{-1}. The importance of vibrational interaction in the mechanism of energy transfer is pointed out. (auth)

9739
PREPARATION OF CERIUM MONOSULFIDE. G. V. Samsonov, N. M. Popova, and L. I. Tikhomirova. Zhur. Priklad. Khim. 31, 153-7(1958) Feb. (In Russian)

A simple method was devised for producing cerium monosulfide CeS. CeO_2 (98% CeO_2, < 0.01% Fe), carbon black with 99.4% C and 0.4% ash, and sulfur (99.9%) were calcined at 900 and 400°. (R.V.J.)

Separation Procedures

Refer also to abstract 10245.

9740 AECU-3689
National Aluminate Corp., Chicago.
CRUD PICK-UP BY MIXED BED ION EXCHANGE. Walter Dominik. Apr. 19, 1956. 6p. For Westinghouse Electric Corp. Bettis Plant. Subcontract 73-AB-71530. $1.80(ph OTS); $1.80(mf OTS).

The residual capacity of mixed resins during the first nine weeks of contact was determined with a synthetic crud in aqueous solution (crud is primary loop water containing suspended corrosion products) containing not less than 5 g of crud per 100 ml of wet resin, and it was compared with the residual capacity of individual cation and anion resins under similar conditions. When fresh anion and cation resins individually and mixed were contacted with a fresh synthetic crud in the range 1.33 to 7.0 milliequivalents of initial resin capacity per gram of crud, the exhaustion of capacity leveled off after 3 to 5 weeks and no additional decrease occurred up to 9 weeks. The absolute capacity decreases were proportional to the amount of crud added. When the cation resin was contacted separately, the capacity exhausted from 22% to 100% depending on the amount of crud added. The exhaustion of the cation capacity was 1.4 to 1.8 milliequivalents per gram of crud. The exhaustion of cation capacity in the mixed bed was 0.2 to 0.3. The exhaustion of the anion capacity alone and in a mixed bed was 0.2 to 0.4. (auth)

9741 AERE-C/R-1488
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PURIFICATION OF CRUDE THORIUM HYDROXIDE. G. J. Ashworth and J. M. Fletcher. Sept. 16, 1954. Decl. Mar. 31, 1958. 18p.

A process for purifying thorium nitrate from the rare earths which accompany it in crude thorium hydroxide, by solvent extraction with 40% TBP/xylene, has been tested. In a miniature extractor run using four stripping and four extraction stages, recovery of thorium has been >99.9% and decontamination factors from rare earths have been between 10^4 and 10^5. Partition coefficients to aid future work have been obtained. (auth)

9742 DP-259
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
EVALUATION OF THE "REVERSE STRIKE" HEAD-END PROCEDURE. David G. Karraker and Sidney G. Parker. Dec. 1957. 15p. Contract AT(07-2)-1. $0.50(OTS).

The "head-end" scavenging of solutions of irradiated uranium with precipitated manganese dioxide was modified to minimize volatilization of ruthenium. The modification involved addition of an excess of manganous nitrate prior to addition of potassium permanganate. (auth)

9743 ISC-662
Ames Lab., Ames, Iowa.
THORIUM AND URANIUM FROM MONAZITE. Martin Welt and Morton Smutz. Aug. 1955. Decl. June 11, 1958. 119p. Contract W-7405-eng-82. $19.80(ph OTS); $6.30(mf OTS).

A process for recovering Th, U, and rare earths from Monazite sands was developed which was economically

feasible and which overcame some of the disadvantages of previous methods. The investigation also included work on alternative methods of purifying the U and Th obtained from the oxalation step. It was demonstrated that U could be recovered completely from sulfate–phosphate liquor by using 10% octyl pyrophosphoric acid in kerosene as the solvent. Additional studies revealed that U could be precipitated from the solvent as UF_4 with 48% HF. A process for separating Th from the Th–rare earth mixture was developed. (J.E.D.)

9744 JENER-54

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

SEPARATION OF U AND Pu FROM Zr, Nb, Ru, AND Cs ON A COLUMN OF MANGANESE DIOXIDE. D. Cvjeticanin and N. Cvjeticanin. Apr. 11, 1958. 10p.

The adsorption of U, Pu, Zr, Nb, Ru, Sr–Y, and Cs was examined to provide a good separation of uranium and plutonium from the fission products mentioned. It was established that it is quantitatively possible to wash UO_2^{2+} and PuO_2^{2+} from a column of manganese dioxide with 0.1 N HNO_3. Under the same conditions, 99.2% of Zr^{95}, Nb^{95}, Ru^{106}, and Cs^{137} was adsorbed. (auth)

9745 K-1019(4th Rev.(Del.))

Oak Ridge Gaseous Diffusion Plant, Tenn.

BASIC CRITICAL MASS INFORMATION AND ITS APPLICATION TO OAK RIDGE GASEOUS DIFFUSION PLANT DESIGN AND OPERATION. H. F. Henry, A. J. Mallett, and C. E. Newlon. Aug. 2, 1957. Decl. with deletions Mar. 13, 1958. 48p. Contract W-7405-eng-26. $1.50(OTS).

The current minimum experimental values of the basic criticality control parameters for U^{235} assays between 2% and approximately 90% are presented together with the basic criticality control methods currently in effect at ORGDP. The fundamental nuclear safety criteria remain essentially unchanged from previous editions of the report with the exception of the neutron interaction specifications, which have been extended considerably, and the approval, for the first time, of the limited use of water in cascade fire control activities. A chart of the organization for nuclear safety control at ORGDP and a glossary are also included. (auth)

9746 USNRDL-TR-231

Naval Radiological Defense Lab., San Francisco.

ANION EXCHANGE STUDIES IN PHOSPHORIC ACID SOLUTIONS. E. C. Freiling, J. Pascual, and A. A. Delucchi. May 7, 1958. 15p.

The applicability of H_3PO_4 solutions to quantitative anion exchange separations was investigated by determining the equilibrium distribution coefficients of Cs, Sr, Ce(III), Zr(IV), Te(IV), Ce(IV), Np(IV), Nb(V), Mo(VI), and U(VI) between Dowex-2 resin in the phosphate form and various strengths of H_3PO_4 solutions. The results show that these elements fall into three groups. The first group, consisting of Cs and Te(IV), does not favor the resin phase to any appreciable extent even at 0.1N H_3PO_4. The group composed of Sr, Ce(III), and Ce(IV) are weakly adsorbed at low H_3PO_4 concentrations ($4 < K_d < 10$). The remaining elements are strongly adsorbed in these solutions ($K_d > 1000$). The adsorption of all elements studied decreases monotonically with increasing H_3PO_4 concentrations. (auth)

9747 AEC-tr-3204

THE ELECTROLYTIC REGENERATION OF SULFURIC ACID IRON PICKLE SOLUTIONS. (Die Elektrolytische Regenerierung Schwefelsaurer Eisenbeizlösungen). H. Hohn, E. Pfitzer, and G. Jangg. Translated from Beiztechnik 6, 109-13(1957). 19p.

A method for continuous regeneration of spent sulfuric acid base iron pickling solutions by electrolysis using mercury electrodes has been developed. In a continuous process the ferrous sulfate is separated, the iron amalgamates with the mercury, and the sulfuric acid is reformed. The amalgam is filtered and the mercury removed by vaporization leaving iron powder. (J.R.D.)

9748

THE EXTRACTION OF TANTALUM AND COLUMBIUM. Donald F. Taylor (Fansteel Metallurgical Corp., North Chicago). Chem. Eng. Progr. 54, No. 4, 47-50(1958) Apr.

A method of extraction of tantalum and niobium from mineral concentrates containing 60 to 80% mixed tantalum and niobium oxides is presented. The method includes extraction of the elements as mixed hydrated oxides, chemical separation of the two, preparation of their pure oxides, reduction to metal powders, and conversion of the metal powders to ductile bars. (J.R.D.)

9749

BERYLLIUM: A CONTINUOUS EXTRACTIVE PROCESS. Kenneth B. Higbie (Beryllium Corp., Reading, Penna.) and Max C. Farmer (National Academy of Science, Washington). Chem. Eng. Progr. 54, No. 4, 51-4(1958) Apr.

A continuous extractive process is described for recovery of beryllium from beryl, a beryllium aluminum silicate. (J.R.D.)

9750

NEW THORIUM PROCESS. R. C. Reid (Massachussets Inst. of Tech., Cambridge); S. H. Jury (Univ. of Tennessee, Knoxville); and J. C. Suddath (Oak Ridge National Lab., Tenn.). Chem. Eng. Progr. 54, No. 4, 76-81(1958) Apr.

The results of an investigation of the vapor phase sodium reduction of thorium tetrachloride are presented along with an outline of the problems encountered in carrying out such a high temperature gaseous reaction. (J.R.D.)

9751

INVESTIGATIONS OF INDIUM HYDROXIDE PROPERTIES AND SEPARATION OF INDIUM FROM ZINC. E. N. Deichman (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk. 257-65(1958) Mar. (In Russian)

Investigations were made of the chemical interactions between indium hydroxides and various concentrations of NaOH. The solubility of indium hydroxide in concentrated solutions of NaOH does not exceed 2×10^{-3} mole/l. The systems $InCl_3$–NaOH–H_2O and $In_2(SO_4)_3$–NaOH–H_2O are free of stable soluble or insoluble indates. Results are given of the crystallographic, thermographic, and x ray analysis of the basic salts and hydroxides of indium and of the solubility in the systems $ZnSO_4$–NaOH–H_2O, $ZnCl_2$–NaOH–H_2O, $In_2(SO_4)_3$–$ZnSO_4$–NaOH–H_2O, and $InCl_3$–$ZnCl_2$–NaOH–H_2O. The optimal conditions for separation of indium and zinc (in hydroxide form) were established. (R.V.J.)

9752

ANION EXCHANGE STUDIES OF Sc(III) AND V(IV). SEPARATION OF SCANDIUM, TITANIUM AND VANADIUM. Robert I. Walter (Brookhaven National Lab., Upton, N. Y.). J. Inorg. and Nuclear Chem. 6, 58-62 (1958) Feb.

The adsorption on Dowex-1 anion exchange resin of Sc^{3+} and V^{4+} tracers has been studied in the presence of low concentrations of oxalate, citrate, fluoride, and carbonate ions. V^{4+} forms strongly adsorbed complex anions with each of these reagents, as does Sc^{3+} with the first two. Both tracers are strongly adsorbed from oxalic acid solution, and their oxalate complexes are selectively destroyed by the addition of hydrochloric acid. These data have been used as the basis of a method for the anion exchange separation of Sc^{3+}, V^{4+} and Ti^{4+} in oxalic acid–hydrochloric acid mixtures. (auth)

9753

PREPARATION OF CARRIER-FREE SCANDIUM AND VANADIUM ACTIVITIES FROM TITANIUM CYCLOTRON TARGETS. Robert I. Walter (Brookhaven National Lab., Upton, N. Y.). J. Inorg. and Nuclear Chem. 6, 63-6(1958) Feb.

A method is described for the separation in high yields of carrier-free Sc^{46} and $V^{48,49}$ activities from deuteron-bombarded titanium cyclotron targets. The procedure involves distillation of V and Ti chlorides (with Sc and Ca chlorides left behind), separation of V from solution in refluxing $TiCl_4$ on a fresh CuCl surface, and removal of milligram amounts of Ti by ion exchange. (auth)

9754

THE DEVELOPMENT AND PROPERTIES OF AN ADSORBENT FOR URANIUM. Leslie A. McClaine, Paul Noble, Jr., and Edward P. Bullwinkel (Arthur D. Little, Inc., San Francisco). J. Phys. Chem. 62, 299-30(1958) Mar.

An adsorbent for uranium from sulfuric acid solutions by formation of a uranyl chelate compound on the surface of a modified porous char was developed. The capacity for uranium is limited by the size of the chelate molecule formed, and the pore size distribution of the adsorbent. (J.R.D.)

9755

EXTRACTION OF INORGANIC SALTS BY 2-OCTANOL. III. ZINC AND CADMIUM CHLORIDES. AQUEOUS PHASE ACTIVITIES. T. E. Moore, Norman G. Rhode, and Robert E. Williams (Oklahoma State Univ., Stillwater). J. Phys. Chem. 62, 370-2(1958) Mar.

The ratio of the molal concentration in the nonaqueous phase to the molal concentration in the aqueous phase is investigated for zinc chloride and cadmium chloride solutions by extraction with 2-octanol at 25°C. (J.R.D.)

9756

ION-EXCHANGE SEPARATION OF BERYLLIUM BY ELUTION WITH SALICYLATE ANALOGS. Jack Schubert, Arthur Lindenbaum, and William Westfall (Argonne National Lab., Lemont, Ill.). J. Phys. Chem. 62, 390-4(1958) Apr.

Rapid quantitative separations of trace quantities of Be from macro-concentrations of salts including those of Cu, U, and Ca were devised. The method makes use of the fact that Be forms a relatively strong complex with salicylate analogs in the region pH 3 to 4.5 whereas most cations of the alkaline earths do not react significantly with salicylates, and cations such as Cu^{2} and UO_2^{2} react weakly or not at all in the same pH region. The separation of Be from foreign cations is made by means of a cation-exchange resin. Be is eluted selectively with 0.02 to 0.10M sulfosalicylic acid (SSA) at pH 3.5 to 4.5. Neither Cu^{2}, UO_2^{2} nor Ca^{2} are removed under these conditions. Uranyl ion is eluted by SSA at pH 4.5 to 4.7. The foreign cations can be removed subsequently by a variety of eluting agents such as HCl and H_2SO_4. At pH > 6 and in the presence of SSA Be is strongly absorbed by an anion-exchange resin. Evidence is given to show that in the acid regions Be forms an uncharged complex with SSA and a negatively charged complex in neutral and alkaline regions. (auth)

9757

A METHOD FOR THE SEPARATION OF PLUTONIUM FROM URANIUM. E. Haeffner and A. Hultgren (AB Atomenergi, Stockholm). Nuclear Sci. and Eng. 3, 471-81(1958) May.

A chromatographic method with possibilities for use on a larger scale has been developed for the separation of plutonium from uranium. Some decontamination from extractable fission products is also obtained. The separation from nonextractable fission products is attained in a primary extraction step. (auth)

Sorption Phenomena

Refer also to abstract 9744.

9758

VARIABLE CAPACITY ANION EXCHANGE RESINS FROM QUATERNIZED DIMETHYLAMINOSTYRENE-STYRENE BEAD COPOLYMERS. Richard H. Wiley and J. M. Schmitt (Univ. of Louisville, Ky.). J. Am. Chem. Soc. 80, 1389-91(1958) Mar. 20.

A series of bead copolymers of dimethylaminostyrene and styrene cross-linked with 1–20% of divinylbenzene have been quaternized with methyl iodide at room temperature. Divinylbenzene cross-linked (10%) resins having exchange capacities of 1.47, 2.35, 2.80, and 3.00 meq/g are described. These capacity values are in agreement with theoretical values calculated on the basis of the copolymer composition and established 96–100% effective quaternization. Partially quaternized resins, quaternized by previously described techniques which give no more than 52% of the theoretical amount of quaternization, can be quaternized up to 88% of the theoretical amount by additional treatment with methyl iodide at room temperature. (auth)

Spectroscopy

9759

VISIBLE AND ULTRAVIOLET ABSORPTION SPECTRA OF $NiCl_2$ DISSOLVED IN FUSED LiCl–KCl MIXTURES. Charles R. Boston and G. Pedro Smith (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 62, 409-14(1958) Apr.

Absorption spectra were measured for solutions of $NiCl_2$ in fused LiCl–KCl mixtures near the eutectic composition over the wave length range of 220 to 750 mμ and at temperatures of 360 to 550°. In the ultraviolet region an absorption band was found with maximum at 260 mμ and a molar absorbancy index of $(3.6 \pm 0.2) \times 10^3$ at 395°. The visible spectrum consisted of four overlapping bands with maxima at 512, ca. 590, 625, and 695 mμ at 398°. The highest of these bands (625 mμ) had a molar absorbancy index of 61 ± 3 at a temperature of 398° and a solvent salt composition of 41.0 mole % KCl. The absorbancy indices of all bands changed considerably with temperature. Furthermore, the ultraviolet band broadened and its maximum shifted to

longer wave lengths with increasing temperature. It was shown that these absorption bands were caused by at least two light-absorbing species derived from $NiCl_2$. With increasing temperature the concentration of one species decreased while the concentration of another species increased. At a constant temperature the concentration of all species giving rise to observed light absorption was proportional to the concentration of total nickel. The spectra were changed by a small but measurable amount with small changes in the composition of the solvent salt. (auth)

9760

ALCOHOLIC FERRIC PERCHLORATE SOLUTIONS. R. A. Horne (Brookhaven National Lab., Upton, N. Y.). J. Phys. Chem. 62, 509-10(1958) Apr.

Absorption spectra of water and alcohol solutions of ferric perchlorate, and curves showing the change in optical density upon addition of water to an alcoholic iron perchlorate solution are presented to support the hypothesis that the colored species of ferric perchlorate is a ferric hydrolysis product, with its color intensified by the substitution of organic molecules for waters in the solvation sphere. (J.R.D.)

Syntheses

9761

THE METALATION OF PHENOXAZINE AND SOME OF ITS DERIVATIVES. Henry Gilman and Leonard O. Moore (Iowa State Coll., Ames). J. Am. Chem. Soc. 80, 2195-7(1958) May 5.

Phenoxazine, 10-ethyl-, and 10-phenylphenoxazine are metalated by n-butyllithium to give what probably are 4-substituted carboxylic acids. Attempts to prove the structures by interconversion of the acids were not successful. 10-Ethylphenoxazine-3-carboxylic acid and 10-(4-carboxyphenyl)-phenoxazine were prepared by a halogen-metal interconversion reaction, which established these structures. (auth)

9762

ISOTOPIC EXCHANGE REACTIONS. II. THE RAPID HALOGEN EXCHANGE BETWEEN $SiCl_4$ AND $(CH_3)_4NCl$, AND A CONVENIENT METHOD FOR THE PREPARATION OF Cl^{36} LABELED CHLOROSILANES. Rolfe H. Herber (Univ. of Illinois, Urbana). J. Phys. Chem. 62, 379(1958) Mar.

The rapid halogen isotope exchange between silicon tetrachloride and tetramethyl-ammonium chloride was investigated, and a method for the preparation of Cl^{36} labeled chloro silanes is presented. (J.R.D.)

Transuranic Elements and Compounds

Refer also to abstracts 9711, 9757, and 10240.

9763

THE HALF-LIFE, NEUTRON CAPTURE AND FISSION CROSS-SECTIONS OF LONG LIVED EINSTEINIUM-254. R. P. Schuman, T. A. Eastwood, H. G. Jackson, and J. P. Butler (Knolls Atomic Power Lab., Schenectady, N. Y. and Atomic Energy of Canada, Ltd., Chalk River, Ont.). J. Inorg. and Nuclear Chem. 6, 1-2(1958) Feb.

The half life of long-lived Es^{254} has been found to be 480 ± 70 days. A measurement of the burn-up of Es^{254} gave a reactor neutron destruction cross section of 2700 ± 600 barns. No Fm^{255}, in equilibrium with Es^{255} was detected after the irradiation, so that the reactor neutron capture cross section of Es^{254} is less than 40 barns. (auth)

9764

SOME OBSERVATIONS ON THE PREPARATION OF NEPTUNIUM OXIDES. D. A. Collins and G. M. Phillips (United Kingdom Atomic Energy Authority, Sellafield, Cumb, Eng.). J. Inorg. and Nuclear Chem. 6, 67-9 (1958) Feb.

Three neptunium oxides have been reported: NpO, NpO_2, and Np_3O_8. Data to support and extend published information concerning physical properties, preparation, and x-ray data are presented. (J.R.D.)

9765

A SIMPLE PREPARATION OF Pu(VI) SULPHATE SOLUTIONS. D. W. Grant (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. and Nuclear Chem. 6, 69-71(1958) Feb.

Plutonium(VI) sulfate has been prepared by ozone conversion of plutonium(IV) sulfate. It is pointed out that while this conversion is quantitative, it may be limited to dilute sulfuric acid solutions because of the reduction of plutonium(VI) by water at high acid concentrations. (J.R.D.)

9766

KINETICS OF OXIDATION-REDUCTION REACTIONS OF PLUTONIUM. THE REACTION BETWEEN PLUTONIUM(VI) AND VANADIUM(III) IN PERCHLORATE SOLUTION. Sherman W. Rabideau (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 62, 414-17(1958) Apr.

The kinetics of the reaction between PuO_2^{+2} and V^{+3} has been studied by spectrophotometric measurements at 8304 Å. The stoichiometry of the reaction is given by the equation $PuO_2^{+2} + V^{+3} + H_2O \rightarrow PuO_2^{+} + VO^{+2} + 2H^{+}$. This second-order reaction has been found to be dependent upon both an inverse first and an inverse second power of the hydrogen ion concentration. Values of k' and k'', the rate constants associated with the inverse first and the inverse second power of the hydrogen ion concentration, have been found to be 2.12 ± 0.03 $sec.^{-1}$ and 0.228 ± 0.006 mole $liter^{-1}$ $sec.^{-1}$, respectively, for perchlorate solutions of ionic strength two at a temperature of 25°. (auth)

9767

EMISSION AND ABSORPTION SPECTRA OF PLUTONIUM EXCITED IN A KING FURNACE. L. Bovey (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Spectrochim. Acta 10, 383-94(1958) Feb.

A list is given of wavelengths of plutonium absorption and emission lines excited in a King-type furnace and photographed in the second order of a 3 m grating instrument over the region 2791-6888 Å. The problems connected with measurement of such lines are briefly discussed and tentative conclusions reached from an attempt to find the energy levels are given. (auth)

Uranium and Uranium Compounds

Refer also to abstracts 9683, 9684, 9694, 9696, 9697, 9714, 9754, 9757, 10235, 10236, 10237, 10238, 10239, 10241, 10242, and 10243.

9768 RDB(C)/TM-142

Gt. Brit. Culcheth Labs., Culcheth, Ches., England. MAGNESIUM REDUCTION OF URANIUM DIOXIDE. INFLUENCE OF MAGNESIUM PRESSURE ON FREE ENERGY OF REACTION. W. G. O'Driscoll. Jan. 16, 1953. Decl. Apr. 18, 1958. 8p.

The variations of the vapor pressure of Mg with the free energy of the reaction of UO_2 with Mg have been calculated over the range 0.01 to 30 atm. An analysis of these data indicates that it is thermodynamically possible to obtain maximum reaction temperatures in excess of the melting point of U (1130°C) when a Mg vapor pressure of at least 1 atm. is maintained during the reaction. (J.E.D.)

9769

THE PREPARATION OF URANIUM METAL BY THE ELECTROLYTIC REDUCTION OF ITS OXIDES. L. W. Niedrach and B. E. Dearing (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 105, 353-8 (1958) June.

The background work is described for a new continuous process for the production of uranium by electrolytic reduction of its oxides in fused salt electrolytes. Unlike past electrolytic processes for uranium production, the present one is operated at temperatures which are above the melting point of the metal. The effect of current, salt bath composition, and other variables on efficiency and cell operation are discussed. An electrolysis bath containing 20 mole % UF_4 diluted with a 50:50 mole % mixture of BaF_2 and MgF_2 was found to be satisfactory. With this bath anode current densities as high as 3.6 amp/cm^2 are feasible without encountering "anode effect." Any of the oxides of uranium can be used as the feed, but UO_3 appears to be preferable. The advantages of the new process are outlined, and the areas requiring additional development work are indicated. (auth)

9770

COMPLEX FORMATION OF URANYL ION WITH o-CRESOTIC ACID; POTENTIOMETRIC, COLORIMETRIC AND CONDUCTOMETRIC STUDY. S. C. Tripathi and Satya Prakash (Univ. of Allahabad, India). J. Indian Chem. Soc. 35, 119-24(1958) Feb.

Like salicylic acid, o-cresotic acid also forms a complex with uranyl ion. The formation of a red-colored complex containing uranyl and o-cresotate in 1:1 molar ratio at about pH 4.5 is demonstrated by the inflection, break, and maximum in colorimeter reading at one equivalent of alkali in all the potentiometric, conductometric, and colorimetric titration curves of different mixtures of uranyl nitrate and monosodium o-cresotate. (auth)

9771

KINETICS OF THE REACTION BETWEEN SODIUM FLUORIDE AND URANIUM HEXAFLUORIDE. I. SODIUM FLUORIDE POWDER. F. E. Massoth and W. E. Hensel, Jr. (Goodyear Atomic Corp., Portsmouth, Ohio). J. Phys. Chem. 62, 479-81(1958) Apr.

The reaction of uranium hexafluoride with sodium fluoride has been found to give a solid addition compound of the formula $UF_6 \cdot 3NaF$. The kinetics of this reaction have been studied at a constant pressure, by weight-change method. The reaction is reversible at higher temperature but dissociation can be safely ignored below 100°C. (J.R.D.)

9772

SYSTEMATICS IN THE VIBRATIONAL SPECTRA OF URANYL COMPLEXES. Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). Spectrochim. Acta 10, 395-403(1958) Feb.

The calculation of U—O bond force constants for uranyl complexes from their infrared absorption spectra is discussed. The maximum error involved in treating the uranyl group as free UO_2^{2+} for calculation of the U—O force constant is estimated to be less than 3 per cent. Approximate anharmonicity constants for general use for the uranyl vibrations are given. The application of Badger's rule relating U—O force constant to U—O bond distance is discussed. (auth)

Waste Disposal

9773

DESIGN AND CONSTRUCTION OF A MODEL PLANT FOR THE PURIFICATION OF RADIOACTIVE WASTES (DECONTAMINATION). Ernst Plötze (Univ. of Freiburg i. B.). Atomkern-Energie 3, 186-90(1958) May. (In German)

The design and construction of a model plant for the purification of radioactive wastes were described. After a description of the start-up procedure, the various methods to test and ascertain the quantitative quality of the decontamination are discussed. (J.S.R.)

9774

THE DISPOSAL OF RADIOACTIVE WASTE MATERIAL. Thomas Jaeger. Atomkern-Energie 3, 190-6(1958) May. (In German)

A survey of the question of the disposal of radioactive wastes and of the adopted and proposed methods is given. 62 references. (J.S.R.)

ENGINEERING

9775 NP-6707

Clevite Research Center, Cleveland.

RESEARCH ON THE LUBRICATION OF TITANIUM. Quarterly Progress Report No. 6 [for] December 15, 1957 to March 14, 1958. N. Fatica. Apr. 1, 1958. 11p. Project No. 50167-G. Contract AF33(616)-3350.

Additional specimens of carburized iron-plated titanium have been prepared and partially evaluated in the Shell Tester at 50-kg load. Although there have been some wide variations in the results obtained, even in the same balls, the results continue to show promise. One test in Mobil Oil SAE 30 at 50-kg load was finally discontinued after 240 hr with a final scar of less than 1½ mm diameter. Photomicrographs of the above specimens show the existence of an intermetallic layer between the iron and titanium phases about one-half mil thick. (For preceding period see NP-6390.) (auth)

9776 WADC-TR-55-30(Pt. 6)

Pennsylvania State Univ., University Park. Petroleum Refining Lab.

FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. [Period covered] January through December 1957. E. Erwin Klaus and Merrell R. Fenske. Feb. 1, 1958. 323p. Project Nos. 3044 and 7331. Contract AF33(616)-2851.

Extensive laboratory evaluation studies are presented for a series of mineral oils and hydrocarbons which have been super-refined by a pilot plant hydrogenation over nickel catalyst. Advantages of hydrogenated and exhaustively acid-refined mineral oils and hydrocarbons over conventionally refined mineral oils are demonstrated for application as base stocks for hydraulic fluids and lubricants. Completed hydraulic fluid formulations containing antifoam, antioxidant, and lubricity additives and jet engine oil formulations containing, in addition to these three additives, Acryloid and

paraffinic resin dispersants are described. A silane, several esters, Spec. MIL-L-7808 fluids, and an improved lubricity silicone hydraulic fluid are evaluated critically in high temperature tests. Properties of used samples of several jet engine oils evaluated in the J-57 jet engine are presented. These samples indicate more fluid deterioration than is predicted by Spec. MIL-L-7808 type stability tests. Several more severe oxidative tests, including the Petroleum Refining Laboratory thin film oxidation test and the isothermal and non-isothermal successive oxidation tests are described. These tests are designed to simulate more nearly the severity encountered in the J-57 engine test. The effects of several variables, including fluid type, fluid molecular weight, additives, fluid flow rate, and air flow rate on the high temperature single-pass lube rig are illustrated. Procedures for the analysis of exhaust gas from the single-pass lube rig have been established to place oxidation encountered in this test on a quantitative basis. Bulk oil oxidation tests of high temperature fluids are shown for test temperatures of 347°, 500°, and 700°F. The effect of fluid type and mineral oil class, degree of refining, and molecular weight are discussed for the 700°F tests. An evaluation of the character of the volatile products of the 700°F oxidation tests is presented. Wear and lubrication studies in the four-ball testers are used to illustrate the additive effects of silicones, silicates, thiocarbamates, and diisopropyl acid phosphite in ester and mineral oil fluid types. Panel coker data in the Model C and controlled atmosphere units are compared and summarized for the effects of fluid type, degree of refining, molecular weight, and additives. The construction of an evaporation unit of the type used in the Federal Test Method Standard No. 791 is described. (For preceding period see WADC-TR-55-30(Pt. 5).) (auth)

9777 WADC-TR-56-272(Pt. III)
Boeing Airplane Co., Seattle.
DESIGN DATA FOR O-RINGS AND SIMILAR ELASTIC SEALS. Period Covered: June 1, 1957 to December 31, 1957. Frank W. Tipton, George E. Trepus, James J. Hill, Ethel L. Schiavon, and Chester J. Dezeih. Feb. 28, 1958. 96p. Project 7340. Contract AF33(616)-2867. (AD-151181).

A study to gain knowledge of design data for O-rings and similar elastomeric seals is continued. The literature survey on O-rings and seal design has been continued and enlarged to include the effects of irradiation and extreme low temperature on seal design. Low temperature tests, relaxation and volume change tests, screening tests, and functional tests have been conducted. The functional tests include pulsed annulus tests with various groove configurations and reciprocating shaft tests with and without different types of back-ups at room temperature and at elevated temperatures. No over-all relationship between physical property values and seal efficiency has been found. It has been noted, however, that certain physical properties appear to be important to seal life for specific seal conditions. (auth)

9778 WADC-TR-56-370(Pt. III)
Shell Development Co., Emeryville, Calif.
RESEARCH IN HIGH TEMPERATURE BEARING LUBRICATION IN THE ABSENCE OF LIQUID LUBRICANTS. Final Report [for] November 1, 1956 through December 31, 1957. R. A. Coit, S. S. Sorem, R. L. Armstrong, and C. A. Converse. May 1958. 44p. Project title: AVIATION LUBRICANTS. Task title: LUBRICANTS. Contract AF 33(616)-2999.

A method of operating rolling contact bearings at high temperatures without using conventional liquid lubricants has been evolved. This method employs a "protective atmosphere" around the bearing. The atmosphere has two functions, the prevention of the formation of abrasive oxides at the bearing surfaces and the formation, by reaction with the bearing surfaces, of anti-scuffing films to prevent catastrophic wear at sliding contacts. Factors involved in the selection of atmosphere compositions and bearing materials for use with this method of operation are discussed. Test operations which have demonstrated the performance of this system at various temperatures from 600 to 1000°F are described. (auth)

9779 IGRL-T/C-83
ON THE RELATIONSHIP BETWEEN POISSON'S RATIO AND THE PLASTIC PROPERTIES OF A MATERIAL. I. I. Cherkasov. Translated by E. Bevitt from Zhur. Tekh. Fiz. 22, 1834-7(1952). 6p.

9780 SCL-T-183
MACHINE FOR WINDING COMPLETELY CLOSED TOROIDS. Translated by Marcel I. Weinreich from French Patent No. 594,091. Inventor: Serge-Simon Held. [Patent] Granted, June 13, 1925. 8p.

A machine for uniformly winding completely closed toroids of any cross section with several layers of wire is described. It contains a main shuttle support which rotates continuously in one direction and has a toroid transport and centering mechanism. One of these components maintains a uniform and adjustable tension on the wire and has various details that makes the machine operate properly. (W.D.M.)

Heat Transfer and Fluid Flow

9781 BW-5429
Babcock and Wilcox Co. Research Center, Alliance, Ohio.
CS-2 NUCLEATE BOILING TEST. PART I. Earl Howells. PART II. K. Mildred Ferguson. Feb. 5, 1957. 52p. $9.30(ph OTS); $3.60(mf OTS).

The objective of this work was to determine if corrosion products from a carbon steel system would deposit on Zircaloy-2 heat transfer surfaces in sufficient quantity to cause measurable changes in heat transfer resistance. The effect of non-boiling and nucleate boiling water was investigated with respect to both the deposition of corrosion products and secondarily, the corrosion of Zircaloy 2 itself. (auth)

9782 BW-5432
Babcock and Wilcox Co. Research Center, Alliance, Ohio.
CS-2 NUCLEATE BOILING TEST. PART I. E[arl] Howells. PART II. K. Mildred Ferguson. May 24, 1957. 36p. For Westinghouse Electric Corp. [Atomic Power Div.]. Subcontract No. 73-14-433. $6.30(ph OTS); $3.00(mf OTS).

These tests indicate that carbon steel can be used in place of high alloy steels to fabricate some components of a pressurized-water reactor system without fear of blocking flow passages or causing overheating of fuel elements due to a decrease in the over-all heat transfer coefficient under the conditions of this test (550°F, 1250 psi water, pH 10). When corrosion products from a carbon steel system deposit on Zircaloy-2 heat transfer surfaces subjected to nonboiling or nucleate boiling water, no significant change in the over-all heat transfer coefficient occurs in 2900 hr of test time. Pressurized water heated to about 550°F will react with

Zircaloy-2 to form zirconium hydride. Slightly more hydride is formed when a nucleate boiling condition exists. The suspended corrosion products level from a carbon steel system containing pH 10 water is nominally 0.03 ppm. The amount deposited on Zircaloy-2 heat transfer surfaces compares favorably with that deposited from a stainless steel system. (auth)

9783 KAPL-1884

Knolls Atomic Power Lab., Schenectady, N. Y.

EVALUATION OF TEST RESULTS ON THE TWO-TUBE (DUPLEX) TEST STEAM GENERATOR NO. 3. E. Y. Stewart. Sept. 6, 1957. 31p. Contract W-31-109-Eng-52. $1.00(OTS).

A two-tube (duplex) steam generator constructed of 2¼% chromium–1% molybdenum alloy steel with an inert gas leak detection system was built and tested. The performance of this steam generator is compared with the performance of similar units constructed of stainless steel. An evaluation is made of the heat transfer data obtained on the unit during the tests. (auth)

9784 NAA-SR-Memo-1740

Atomics International Div., North American Aviation, Canoga Park, Calif.

STEADY STATE TEMPERATURE AND THERMAL STRESS DISTRIBUTIONS IN PLATES, CYLINDERS, AND SPHERES WITH UNIFORM INTERNAL HEAT GENERATION. J. E. Gingrich and T. T. Shimazaki. [195?]. 35p. $6.30(ph OTS); $3.00(mf OTS).

To serve as a convenient reference, a tabulation is presented of the steady-state temperature and thermal stress distribution equations for plates, cylinders, and spheres with uniform internal heat generation. (auth)

9785 NACA-TN-4209

Lewis Flight Propulsion Lab., Cleveland.

EXPERIMENTAL THERMAL CONDUCTIVITIES OF THE $N_2O_4 \rightleftharpoons 2NO_2$ SYSTEM. Kenneth P. Coffin and Cleveland O'Neal, Jr. Feb. 1958. 22p.

Thermal conductivity was measured by a hot-wire technique at temperatures between 20 and 215°C and pressures from ⅓ to 1 atmosphere; approximate values were obtained at pressures as low as 0.02 atmosphere from 20 to 80°C. Experimental values are in good agreement with values calculated so as to include the effects of dissociation; dissociation produces an order-of-magnitude increase in conductivity. (auth)

9786 ORO-170

North Carolina State Coll., Raleigh.

THE MEASUREMENT OF THERMAL PROPERTIES OF NONMETALLIC MATERIALS AT ELEVATED TEMPERATURES. Final Report. K. O. Beatty, Jr., and A. A. Armstrong. June 30, 1956. 59p. Contract AT(40-1)-1319. $1.75(OTS).

Knowledge of the thermal properties of nonmetallic substances such as refractories and insulators is of great importance in the design of equipment made out of such materials. Often in nonmetallic equipment the rate of heat transfer through or the temperature distribution within parts of the equipment may be of controlling significance, and therefore it is important to have convenient and accurate methods of determining the thermal properties, i.e., thermal conductivity, thermal diffusivity, and specific heat. This report is divided into two parts. In the first part the principal results of the mathematical analysis are given in useful form, and a description of the application of these results to the interpretation of data from experimental runs is given. In the second part a more detailed account is given of the 13 different sets of boundary value problems and their solutions that have been used in narrowing the gap between mathematically judicious and physically possible conditions. (A.C.)

9787 SCTM-287-57(51)

Sandia Corp., Albuquerque, N. Mex.

DEVELOPMENT OF AN EXPLICIT EQUATION FOR TURBULENT SKIN-FRICTION COEFFICIENT FROM VAN DRIEST'S THEORIES FOR FLAT PLATE AND CONE. W. M. Burley, Jr. Aug. 30, 1957. 17p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

Van Driest's turbulent boundary layer theories are useful for determining heat transfer coefficients and skin temperatures for bodies moving at supersonic speeds. Since Van Driest's results are in a form difficult to evaluate, an explicit equation for skin-friction coefficient was developed by curve-fitting which gives good accuracy for the ranges of Mach numbers from 1.0 to 8.0, temperature ratios from 1.0 to 6.0, and Reynolds' numbers from 1×10^6 to 100×10^6. (auth)

9788 WADC-TR-58-85

Minnesota. Univ., Minneapolis. Heat Transfer Lab.

INCOMPRESSIBLE FRICTION FACTOR, TRANSITION AND HYDRODYNAMIC ENTRANCE LENGTH STUDIES OF DUCTS WITH TRIANGULAR AND RECTANGULAR CROSS-SECTIONS. E. R. G. Eckert and T. F. Irvine, Jr. Apr. 1957. 40p. Project No. 54-630-496. Contract AF33(616)-474. (AD-151027).

Measurements are presented on friction factors, critical Reynolds numbers, and hydrodynamic entrance lengths of air flowing with subsonic velocities through non-circular ducts. The data were obtained for two ducts: one having the shape of an isosceles triangle with a 23 degree apex angle, and the other a rectangular duct with a width to breadth ratio of 3. The results of these measurements clarify discrepancies which existed in the literature on friction factors for developed laminar flow. They give new information on hydrodynamic entrance lengths and on critical Reynolds numbers for transition to turbulence. (auth)

9789

NEW INVESTIGATION ON THE HEAT TRANSFER OF WATER, A CONTRIBUTION TO THE PROBLEM OF WATER COOLED REACTORS. Günther Grass. Atomkern-Energie 3, 175–82(1958) May. (In German)

Heat transfer of water flowing in tubes was tested at flow rates of 0.4 to 40 m/sec. New data were obtained on the influence of tube diameter, temperature, and surface conditions being important for water cooling of reactors. (auth)

9790

HEAT EMISSION THROUGH FREE CONVECTION IN FLUID COOLING OF GAS TURBINE BLADES. B. A. Dmitriyev. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk No. 5, 103-7(1956). (Translated from Referat. Zhur. Mekh. No. 6, 1957, abstract no. 6830.)

The process of natural convection of an incompressible fluid in a stationary closed duct with constant wall temperature is studied. The basis of the solution of the problem is the physical system of flow in a duct, proposed by Laytkhill. Complementing Laytkhill's expressions for the temperature and velocity of fluid in the duct with terms dependent on the square of the transverse (radial) coördinate, the author uses an approximate method to solve Laytkhill's equations of flow, energy, and continuity, reduced to dimensionless form. The results of the approximate determination of the coefficient of heat transfer in the duct are estimated by a criterial equation of the form: $N = cG^mP^n(l/b)^h$, where N is Nusselt's number, G is Grashoff's number,

P is Prandtl's number, l is the length of the duct, and b is the radius. A graph of the results of the experimental study of heat transfer in a closed duct and a generalized empirical heat transfer formula are presented.

9791

EXPERIMENTAL INVESTIGATION OF HEAT EMISSION FROM A BOILING SOLUTION OF CAUSTIC SODA IN A VERTICAL TUBE WITH NATURAL CIRCULATION. A. G. Bondar. Izvest. Kiev. Politekhn. Inst. 17, 83-97 (1956). (Translated from Referat. Zhur. Mekh. No. 5, 1957, abstract no. 5703.)

Results of investigations in the determination of heat emission with boiling solutions of caustic soda, NaOH, in a vertical tube with natural circulation are presented. The object of this research was to obtain data for reliable calculation of heating surfaces in equipment for the evaporation of NaOH solutions and to establish optimum operating conditions. A system of specially designed experimental equipment is described. The methods of measurement and of processing the experiments are described in detail. In particular, the specific heat flow q was determined by the quantity of condensate formed on the surface of the boiling tube at separate sections, the quantity of heat necessary for dehydration being taken into account. It is claimed that the relative error in the determination of α_2 for the minimum and maximum heat load (q equal to 1700 and 74,200 kcal/m^{2}hr, respectively) fell within the range of five to eight %. The determination of optimum hydrodynamic conditions for the boiling of NaOH solutions for required concentrations was performed through a series of experiments, differing in the apparent level of the boiling solution in an oxidized steel tube (diameter 32/38 mm, length 1500 mm). Experiments were conducted under these conditions with the object of determining values of α_2, the coefficient of heat transfer for boiling solutions of NaOH of various concentrations, and of establishing the dependence of α_2 upon q and the physical properties of the solutions under secondary vapor pressures equal to atmospheric pressure for 5, 10, and 20% solutions, and varying in the range of 0.62 to 0.76 kg/cm^2 for 15, 30, and 40% solutions. It is claimed (within the range of the parameters of these experiments) that α_2 is proportional to q by the power n = 0.564 to 0.620. The results obtained are in accord with the data of other authors. In particular, it is emphasized that, with identical heat flow, the coefficients of heat emission to water are greater than to the solution. The quantity α_2 to the solution decreases with increased temperature. Using a special movable thermocouple, the author shows that in the boiling of solutions in a vertical contour with natural circulation, a considerably greater amount of super-heating (~2°) takes place than in large-scale boiling. It is pointed out that under optimum conditions the solution is at the greatest temperature, as a rule, at the initial region of the evaporating tube.

9792

THE STUDY OF HEAT EMISSION AND RESISTANCE IN THE CASE OF BUNDLES OF TUBES IN A CROSS-FLOW OF A LIQUID. S. A. Romanovskiy. Izvest. Kiev. Politekhn. Inst. 17, 134-42(1956). (Translated from Referat Zhur. Mekh. No. 6, 1957, abstract no. 6814.)

As the result of the experimental investigation of heat emission from "checker-board" lattices of pipes in a cross flow of liquid, conducted on models with a relative pitch s/d of 1.5, 1.75, and 2.3 in a temperature range from 40° to 90° and with Reynolds numbers from 4×10^3 to 9×10^4, the following formula was obtained: $N_f = 0.38\ R_f^{0.6}\ P_f^{0.4}\ (P_f/P_w)^{0.25}$, where P is Prandtl's number. It is shown that the dimensionless parameter $(P_f/P_w)^{0.25}$ makes it possible to generalize data on heat emission in the flow of liquids and gases. Experiments in the study of the hydraulic resistance of the pipe clusters were conducted only under isothermal conditions. The results of these experiments are presented in the form of an empirical relationship.

9793

INVESTIGATION OF HEAT EMISSION IN TURBULENT FLOW OF FLUIDS IN NARROW CHANNELS OF RECTANGULAR CROSS-SECTION. N. V. Tsarenko. Izvest. Kiev. Politekhn. Inst. 17, 143-53(1956). (Translated from Referat. Zhur. Mekh. No. 5, 1957, abstract no. 5687.)

Results of the investigation of heat exchange in the case of the cooling of water moving through a straight tube of rectangular cross section are presented. The interval of variation of the Reynolds number R was from 1×10^4 to 6×10^4, the relative height of the tube was varied from three to ten, its relative length from 70 to 200; the minimum width was 1.8 mm. A description of the apparatus is given, and several questions in the experimental method are discussed. Formulas and graphs, specifying the data obtained and the results of their comparison with data of other authors, are included. The formula $N = 0.023\ R^{0.8}P^{0.4}$, where N is Nusselt's number, and P is Prandtl's number, was proposed for the determination of the intensity of heat exchange. The determining dimension is the equivalent diameter d = 4f/u, where f is the area of the cross-section, and u is the wetted perimeter. The physical constants are related to the average temperature of the fluid. The influence of the number P was not determined. It is noted that the intensity of the heat exchange is not affected by free convection. The influence of the stabilizing section was also not determined. Good agreement is claimed between the obtained data and results of experiments dealing with the case of the heating of air. Considerations ascribing this agreement to a difference in the action of temperature on the properties of gases and liquids are not very convincing.

9794

HEAT EMISSION FROM A HORIZONTAL PIPE, WITH FREE FLOW OF VARIOUS FLUIDS. I. M. Mikheyeva Teploenergetika No. 4, 19-21(1956). (Translated from Referat. Zhur. Mekh. No. 5, 1957, abstract no. 5690.)

On the basis of data obtained personally and from the literature, the following formula, constructed according to the common formula for forced convection, is recommended: $N_f = 0.51\ G_f^{0.25}\ P_f^{0.25}\ (P_f/P_f)^{0.25}$ (where N is Nusselt's number, G is Grashoff's number, and P is Prandtl's number).

9795

THE INFLUENCE OF THE DIRECTION OF FLUID FLOW ON THE TEMPERATURE CONDITIONS IN HEAT EXCHANGERS. F. F. Zigmund. Trudy Kazan. Khim. Tek. Inst. No. 19-20, 381-420(1955). (Translated from Referat. Zhur. Mekh. No. 6, 1957, abstract no. 6854.)

The temperature conditions in heat exchangers under constant aggregate heat-carrier conditions are studied. A classification of heat exchangers is made, with respect to the nature of the heat-carrier flow and with respect to the construction of the heat exchangers. Specific constructions and conditions for their efficient use are analyzed. Calculation formulas and specific examples of the calculation of the mean temperature difference for various construction types of heat exchangers

are given. For the sake of simplification of calculations, the "isothermicity factor" is introduced, which, multiplied by the difference of the initial fluid temperatures, gives the value of the mean temperature difference. Auxiliary graphs are constructed for the determination of the "isothermicity factor" with respect to the initial and final temperatures of the heat carriers for various designs of heat exchangers. Examples of calculations and auxiliary graphs are given for the design of heat exchangers with complex flow systems, and also for heat exchangers in which one of the fluid is stationary and for heat exchangers with concentric coils.

9796

THE STUDY OF THE CHARACTERISTICS OF THE HEAT TRANSFER PROCESS DURING BOILING IN PIPES. N. Yu. Tobilevich and B. A. Yeremenko. V. sb. Gidrodinamika i Teploobmen Pri Kipenii v Kotlakh Vysokogo Davleniya Akad. Nauk S.S.S.R. 186-205(1955). (Translated from Referat. Zhur. Mekh. No. 6, 1957, abstract no. 6840.)

9797

CRITICAL HEAT REMOVAL IN THE FLOW OF NON-BOILING WATER FOR A CIRCULAR SPACE. V. S. Chirikin and V. P. Yukin. Zhur. Tekh. Fiz. 26, No. 7, 1542-5(1956). (Translated from Referat. Zhur. Mekh. No. 6, 1957, abstract no. 6841.)

The results of the experimental determination of the magnitude of the critical heat flow q in cooling by non-boiling water are presented; q corresponds to the formation of a vapor film between the cooled solid surface and the flow of fluid. In the experiments, the magnitude of the critical heat flow was determined by the conditions at the point of critical heat removal, corresponding to the transition for active boiling in the boundary layer of film boiling. Two experimental setups were used, and these are schematically illustrated. Special emphasis is placed on the arrangement of the working area, the design of equipment used to distinguish pressures, and the construction of the heat-emitting element. The methods of measurement and calculation of experimental quantities are described, and possible errors in their determination are evaluated. In the experiments a regulated transformer was used to increase uniformly the voltage and current in the heat-emitting element. At the critical point of heat removal, the heat emitter usually burned out and an open circuit occurred: the desired quantities were measured at that time. The experimental data are presented in the form of graphs and tables, the analysis of which yields empirical relationships determining the dependence of q on the velocity of the non-boiling water at the inlet to the working area (in the range of 1.5 to 15.1 m/sec), on the average value of the temperature of the water at the exit (from 14 to 137°), on the size of the clearance δ between the external tube and the cylindrical heat-emitting element (varying from 0.5 to 5.6 mm), and on the pressure p (ranging from 1 to 22 atm. abs.). The effect of surface roughness on q is studied in detail. The relationship between the critical heat flow q_1 for a rough surface and q_0 for a technically smooth surface takes the form of $q_1 = \varphi q_0$, where φ is an experimental coefficient, determined by the type of surface and the nature of the fluid. The values of φ presented refer to a pipe of 10 mm diameter for width δ = 1.45 + 1.50 mm, with a velocity of water (or mixture) equal to 2.77 + 2.83 m/sec, and at a temperature of 40 to 45°.

9798

MASS TRANSFER BY FORCED CONVECTION IN LAMINAR BOUNDARY LAYERS. H. J. Merk. 'S-Gravenhage, Excelsior. [1958]. 133p. (In Dutch)

The calculation of transfer processes by convection and molecular diffusion is based upon a system of partial differential equations and their boundary conditions. The partial differential equations are called the macroscopic equations and are derived from the laws of conservation of mass, momentum, and energy. The boundary-layer equations for combined mass and heat transfer are discussed, but the discussion is restricted to laminar, steady, two-dimensional and rotationally symmetrical boundary-layer flow. The influence of the convective compensating velocity for the case of a boundary layer along a smooth flat plate without longitudinal pressure gradient and for an incompressible fluid with a constant coefficient of viscosity is studied in detail. Maksyn's method of mass transfer calculations for boundary layers with longitudinal pressure gradients is refined, and the parameters needed for the application of the method are calculated. The results are applied to the calculation of local transfer numbers for circular cylinders, two elliptical cylinders, and spheres. An attempt is made to calculate the influence of the convective compensating velocity on the local mass transfer coefficients. (J.S.R.)

Materials Testing

9799 DP-271

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

STRESSES IN RINGS. PART II. J. Walter Joseph, Jr. Feb. 1958. 19p. Contract AT(07-2)-1. $0.75(OTS).

A general mathematical analysis of forces and moments in elastic rings that are stressed by equal loads spaced uniformly around the circumference was verified by an experimental study in which photoelastic techniques were used. The experiments confirmed the general analysis and showed that the direct forces in a ring should not be neglected if the number of loads exceeds five. (auth)

9800 NAVORD-1183

Naval Ordnance Test Station, Inyokern (China Lake), Calif.

THE BEHAVIOR OF METAL UNDER HIGH AND RAPIDLY APPLIED STRESSES OF SHORT DURATION. John S. Rinehart. Sept. 27, 1949. 22p. (NOTS-239).

Approved version of RRB-39.

Several interesting effects produced as a result of detonating charges in intimate contact with metal plates, rods, and tubes are described. The principal observable effects are as follows: fracturing of the metal caused by a tensional stress produced as a result of the reflection of a high compressional stress wave at a free boundary, the fracturing of the metal caused by high stress concentration, and permanent straining of the metal. (auth)

9801 NP-6720

Utah. Univ., Salt Lake City. Coll. of Engineering.

A STUDY OF THICK-WALLED CYLINDERS AS TENSILE MEMBERS FOR HIGH PRESSURE VESSELS, WITH PARTICULAR ATTENTION TO STEEL AND THEIR HEAT TREATMENT FOR MAXIMUM PERFORMANCE. Technical Report No. III. William A. Boyd and S. S. Kistler. Mar. 1958. 108p. Project No. NR-052-357. Contract Nonr-1288-(02).

Steel rings were subjected to an internal stress by forcing onto a tapered arbor. Internal strain was measured by travel on the arbor; external strain by micrometer. Plastic deformation and the effect of

pressure on the yield point of the inner fibers were studied. (T.R.H.)

Pumps

Refer also to abstract 10247.

9802 AECU-3667
General Electric Co. General Engineering Lab., Schenectady, N. Y.
THE DESIGN OF A NUCLEAR COOLANT PUMP SPEED SENSOR. G. F. Skala. Mar. 13, 1958. 20p. (58-GL-84). $3.30(ph OTS); $2.40(mf OTS).

The design utilizes a 12-pole rotor with poles of magnetic 410 stainless steel. A voltage, the frequency of which is proportional to pump speed, is generated by a coil wound on a magnetized core. The coil is inserted in a well similar to that used for thermocouples. No penetration by electrical wires of the pump seal is required, and the coil can be readily replaced. (auth)

9803 HW-43929
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
JOHNSTON SPLINED SHAFT DEEPWELL TURBINE PUMP. Interim Report. J. Dunn. June 25, 1956. 12p. Contract W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Operational testing, using water and 60% nitric acid, of a prototype deep-well turbine pump of splined-shaft construction designed for use in the HAPO separation plants is described. The pump has more rugged rotating components, wear-resistant journals, and positive attachment of the impellers than those developed earlier. (J.R.D.)

Waste Disposal

Refer to abstract 10194.

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

9804 NP-6704
Firth Sterling, Inc. American Electro Metal Div., Yonkers, N. Y.
CEMENTED METALLIC BORIDES. Final Summary Report [for] September 1, 1956–December 31, 1957. Mar. 1, 1958. 59p. Contract Nonr-2218(00).

As the impact strength of Borolite IV (Cr_2B–chromium–molybdenum alloy) was not improved by the addition of small amounts of other metals, emphasis was placed on the purification by direct reaction in vacuum and sintering in vacuum. No appreciable improvement of the impact strength was found. The physical properties and microstructure of the pure Borolite IV were investigated, and the results are tabulated. The breaking strength of hard metals, especially boride-base materials, was investigated at high temperatures, usually well above 1000°C. The transverse rupture strengths of Borolite IV, Borolite III, chromium–20% molybdenum alloy, molybdenum disilicide, CrB, Cr_2B, titanium diboride, vanadium diboride, zirconium diboride, and zirconium carbide were determined as a function of temperature. Borides of lanthanum, europium, gadolinium, dysprosium, and neodymium and a ternary gadolinium nickel boride were prepared and the lattice constants determined. (J.S.R.)

9805 NP-6718
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
INVESTIGATION OF HIGH TEMPERATURE RESISTANT MATERIALS. Quarterly Report No. 11 [for] February 1, 1958 to April 30, 1958. J. D. Walton and C. R. Mason. 35p. Project No. A-212. Contract NOrd-15701.

Thermitic Cermets. Zirconium-carbide- and titanium-carbide-forming thermite reactions were studied with regard to throttling materials (alumina and kaolin), binders (core oil, $Al(OH)_3$ saturated solution), carbon source (graphite, lampblack), and shrouding techniques. Kaolin was superior to alumina. Core oil proved unsatisfactory due to its volatility after drying. Graphite produced harder bodies than lampblack. The best shrouding technique was to shroud in lampblack and an outer wrap of kaolin wool. Rocket Nozzle Material. Nozzles fabricated from the thermite reaction of silica and aluminum were weakly bonded. The nozzles from a ZrC-forming reaction with kaolin as throttler melted when tested. (For preceding period see NP-6601.) (T.R.H.)

9806 WADC-TR-58-12(Pt. 1)
Illinois. Univ., Urbana.
HIGH-TEMPERATURE ELECTRICAL INSULATING INORGANIC COATINGS ON WIRE. Period covered: February 1957 to January 1958. Clifton G. Bergeron, Arthur L. Friedberg, Paul F. Schwarzlose, Robert J. Beals, and William M. Faber. Jan. 1958. 78p. Project title: CERAMIC AND CERMETS MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-3943. (AD-151079).

An investigation was undertaken to develop and evaluate high-temperature electrical insulating inorganic coatings for copper wire, and to develop methods for applying these materials to wire. Test procedures were developed for determining the dielectric strength, dielectric constant, and dissipation factor of experimental coatings on both sheet copper and copper wire. Certain coating compositions formulated in the alkali–B_2O_3–SiO_2 system were found to have the requisite dielectric properties at room temperature. Equipment was designed and constructed for continuously applying and firing vitreous coatings onto copper wire. The considerations relating to flexibility and dielectric properties of the coated wire are discussed. (auth)

9807
STATISTICAL AND CYCLIC STABILITY OF TUNGSTEN CARBIDE–COBALT METAL CERAMICS. G. S. Kreimer, A. I. Baranov, and O. S. Safonova (All Union Inst. of Solid Alloys). Fiz. Met. i Metalloved. 5, 361-4 (1957). (In Russian)

Experimental tests were made of the stability limits and other mechanical properties (stability limits on bend, hardness, etc.) of 94% WC and 6% Co metal ceramics with various size grains. The results showed that the stability and statistical limits are lower with smaller grains; however, the statistical limit is less pronounced. It was concluded that the reduced plasticity of cobalt layers caused by diminished thickness of the layer also caused the lower stability of the layers and of the stability limits of the alloy as a whole. (R.V.J.)

9808

INVESTIGATION OF THE TEMPERATURE DEPENDENCE OF THE COMPLETE POLARIZATION, COERCIVE FORCE, AND HYSTERESIS LOSS OF POLYCRYSTALS OF SOLID SOLUTIONS OF (Ba, Sr)TiO_3, Ba(Ti, Sn)O_3 AND Ba(Ti, Zr)O_3. V. A. Bokov (Inst. of Semiconductors, Leningrad). Zhur. Tekh. Fiz. 28, 77-86(1958) Jan. (In Russian)

It was shown that spontaneous polarization of solid solutions of Ba(Ti, Sn)O_3 and Ba(Ti, Zr)O_3 decreases as the content of $BaTiO_3$ decreases; the spontaneous polarization of solid solutions of (Ba, Sr)TiO_3 decreases as the amount of $SrTiO_3$ is increased up to 40 wt. %, and increases as the amount of $SrTiO_3$ is increased from 40 to 50 wt. %. It is also shown that the coercive forces and hysteresis loss decrease during the transition from tetragonal phase into orthorhombic and from the orthorhombic into rhombohedron form. Within the limits of each phase the coercive forces and hysteresis loss increase as the temperature is lowered. (tr-auth)

9809

SINTERING OF MULTI-PHASE BODIES. IV. SINTERING OF POWDERED MIXTURES OF REFRACTORY METALS. B. Ya. Pines and A. F. Sirenko (Gor'kii State Univ., Kharkov). Zhur. Tekh. Fiz. 28, 150-8 (1958) Jan. (In Russian)

Investigations of sintering the metallic powders of Cr-Mo, Cr-W, and Ni-W revealed a similar shrinkage and tensile strength quadratic concentration dependence similar to that which had been observed earlier with the mixtures of Fe-Cu, Fe-Ni, and Ni-Cu. It is shown that during the sintering of Cr-Mo and Cr-W, heterodiffusion accompanies the process; moreover, in the above mixtures the atoms of Cr are the diffusing elements and in the mixture of Ni-W the atoms of W. (tr-auth)

Corrosion

Refer also to abstracts 9734, 9781, and 9782.

9810 NP-6708

Ohio State Univ. Research Foundation, Columbus. PROTECTION OF NIOBIUM AGAINST OXIDATION AT ELEVATED TEMPERATURES. Status Report for the period July 16, 1957-March 15, 1958. J. W. Spreynak and Rudolph Speiser. Mar. 28, 1958. 23p. RF Project 467, Report 16. Contract N6onr-225(28).

The oxidation behavior of niobium-zirconium alloys from 800 to 1000°C and of niobium-titanium-chromium alloys from 800 to 900°C was observed along with some physical properties of niobates. Oxide coatings on various alloys in the binary and ternary systems were studied in elevated temperature oxidation experiments, and the spallation characteristics of cooled samples described. (J.R.D.)

9811 AEC-tr-3253

CONCERNING STRESS CORROSION IN NON-IRON METAL ALLOYS. H. Vosskühler. Translated from Metall 11, 193-6(1957). 12p.

The most essential measures or states that effect a change of potential in aluminum alloys are discussed, and stress corrosion appears in these alloys when intercrystalline and transcrystalline locations are anodic with respect to the remainder of the crystal surface, the fracture progressing in two states. The first phase in a given instance extends over a relatively long time; light attack takes place, and the main emphasis is on corrosion. In the second phase, when the attack proceeds far enough in a particularly susceptible area that the equilibrium is disturbed, the flow process sets in, breaking the covering layer in the bottom of the notch and the baser potential of the virgin metal comes into action in increased corrosion caused by it; then renewed flow leads to an autocatalytic acceleration of the process and finally to fracture. (J.R.D.)

9812

CORROSION BY WATER AT HIGH TEMPERATURES OF MONOCRYSTALS OF HIGH PURITY ALUMINUM. Jean Hérenguel and Pierre Lelong. Compt. rend. 246, 2481-4(1958) Apr. 28. (In French)

The corrosion of high-purity monocrystalline samples of aluminum in 270°C water for 10 hr was investigated. Two mechanisms of attack were found: formation of a compact homogeneous film with constant thickness and erosions with very disordered penetrations toward the interior of the metal. The erosion attack succeeds the regular attack. Where the erosions are not established, the surface of the metal ripples. Each valley is actively attacked, the oxide formed having fissured in scales parallel to the interface. The summits have a zone of erosion. (J.S.R.)

9813

DIFFUSION OF OXYGEN IN ZIRCONIUM AND ITS RELATION TO OXIDATION AND CORROSION. J. Paul Pemsler (Nuclear Metals, Inc., Cambridge, Mass.). J. Electrochem. Soc. 105, 315-22(1958) June.

The diffusion of oxygen in zirconium and dilute zirconium alloys has been studied in the temperature range of 400° to 585°C by observing the rates of dissolution of anodically deposited interference oxide films. The diffusion coefficient of oxygen in zirconium depends on the grain orientation and varies by a factor of two among different orientations. Macroscopically observed average values obey the equation $D(cm^2/sec) = 9.4 \exp[(-51{,}780 \pm 220)/RT]$, where the activation energy for the diffusion of oxygen in zirconium is 51.78 kcal/mole. No macroscopic differences were observed in the diffusion coefficients of the various dilute alloys. Oxidation and corrosion rates have been observed to have an orientation dependence similar to that observed in the diffusion study. The mechanism of oxidation and corrosion is discussed in terms of diffusion of oxygen and adherence of oxide films. (auth)

9814

CHEMICAL FACTORS AFFECTING STRESS CORROSION CRACKING OF 18-8 STAINLESS STEELS. H. H. Uhlig and John Lincoln, Jr. (Massachusetts Inst. of Tech., Cambridge). J. Electrochem. Soc. 105, 325-32 (1958) June.

Transgranular stress corrosion cracking of 18-8 Type 304 specimens in boiling 42% $MgCl_2$ does not depend on rate of stressing (<1 sec to 10 min) nor on small variations in degree of plastic deformation. Cold worked specimens fail in shorter times than annealed, sheared specimens. Addition of HCl to $MgCl_2$ decreases cracking time whereas addition of NaOH increases the time. Pre-exposure of unstressed specimens to $MgCl_2$ slightly decreases cracking times of the same specimens subsequently stressed. Cracks occur along sheared edges of unstressed specimens despite stress relief anneal at 375°C for 2 hr. Cracks propagate along sheared edges of U-bend specimens at 0.5 to 1 cm/hr through that portion of the specimen cross section in tension, the rate being much slower through the remaining cross section. No induction time for cracks to initiate was observed. Sizeable pits are not necessary for cracking in $MgCl_2$, but appear to be essential in

media like NaCl which in absen e of pitting is not particularly active in causing cracking. The pitting mechanism produces concentrated low pH metal chlorides (e.g., $FeCl_2$) within the pit, which like $MgCl_2$ cause immediate cracking. Oxygen is required for pitting of 18-8 by NaCl solutions as shown by Uhlig and Morrill, and hence also for stress corrosion cracking as observed by Williams and Eckel, but oxygen is not necessary in $MgCl_2$ or $FeCl_2$. Cracking can be prevented by cathodic protection at a C.D. of 0.03 ma/cm^2 or higher. Anodic C.D. up to 0.01 ma/cm^2 were found to have no effect on cracking tendency, nor did coupling of 18-8 to Pt. (auth)

Geology and Mineralogy

9815

PRELIMINARY GEOLOGIC MAP OF THE WEST CENTRAL PART OF THE BURDOCK QUADRANGLE FALL RIVER COUNTY, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 71. R. W. Schnabel and L. J. Charlesworth, Jr. Washington, U. S. Geological Survey, 1958. $0.50.

9816

PRELIMINARY GEOLOGIC MAP OF THE NORTHEAST PART OF THE BURDOCK QUADRANGLE FALL RIVER AND CUSTER COUNTIES, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 72. R. W. Schnabel and L. J. Charlesworth, Jr. Washington, U. S. Geological Survey, 1958. $0.50.

9817

PRELIMINARY GEOLOGIC MAP OF THE SOUTHEAST PART OF THE BURDOCK QUADRANGLE FALL RIVER AND CUSTER COUNTIES, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 75. R. W. Schnabel and L. J. Charlesworth, Jr. Washington, U. S. Geological Survey, 1958. $0.50.

9818

URANIUM DEPOSITS AND PRINCIPAL ORE-BEARING FORMATIONS OF THE CENTRAL CORDILLERAN FORELAND REGION. MINERAL INVESTIGATIONS MAP MF 120. T. L. Finnell and I. S. Parrish. Washington, U. S. Geological Survey, 1958. $0.75.

9819

PRELIMINARY GEOLOGIC MAP OF THE CIRCLE CLIFFS 1 SW QUADRANGLE GARFIELD COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 155. L. D. Carswell, E. S. Davidson, and G. A. Miller. Washington, U. S. Geological Survey, 1958. $0.50.

9820

PRELIMINARY MAP OF BEDROCK GEOLOGY OF THE RALSTON BUTTES QUADRANGLE, JEFFERSON COUNTY, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 179. Douglas M. Sheridan, Charles H. Maxwell, Arden L. Albee, and Richard Van Horn. Washington, U. S. Geological Survey, 1958. $0.50.

9821

PHOTOGEOLOGIC MAP OF THE JOHNSON NW QUADRANGLE, KANE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-267. J. S. Pomeroy. Washington, U. S. Geological Survey, 1958. $0.50.

9822

PHOTOGEOLOGIC MAP OF THE PARIA NW QUADRANGLE, KANE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-268. Kathleen McQueen and R. G. Ray. Washington, U. S. Geological Survey, 1958. $0.50.

9823

COMPARISON OF THE $^{87}Rb \rightarrow {}^{87}Sr$ AGES OF THE RED GRANITE OF THE BUSHVELD COMPLEX FROM MEASUREMENTS ON THE TOTAL ROCK AND SEPARATED MINERAL FRACTIONS. G. D. L. Schreiner (Univ. of the Witwatersrand, Johannesburg). Proc. Roy. Soc. (London) A245, 112-17(1958) May 6.

Age determinations on a portion of the total crushed rock and on the felspar fraction of each of four widely separated samples of the red granite from the Bushveld complex are reported. A single determination from the separated biotite of one sample was made. These nine determinations lead to a mean age of 2.41×10^9 years [$t_{½} = 6.3 \times 10^{10}$ years] or 1.92×10^9 years [$t_{½} = 5.0 \times 10^{10}$ years]. There are no variations between individual determinations that are significant at the 99% confidence level. For the unweighted mean age of the 99% confidence limits are $\pm 0.13 \times 10^9$ years. Despite the low enrichment of Sr^{87} the "total rock" method shows 99% confidence limits of $\pm 0.22 \times 10^9$ years for the mean of four determinations. (auth)

9824

CONTRIBUTION TO THE KNOWLEDGE OF SOME URANINITES AND PITCHBLENDES OF THE ARGENTINE REPUBLIC. C. E. Gordillo, E. Linares, and R. J. Poljak. Publs. com. nacl. energia atomica (Buenos Aires) Ser. geol. 1, 1-34(1957). (In Spanish)

In this paper some uraninites and pitchblendes from the Argentine Republic are studied. First, the mineralogical and geological characteristics of these minerals and their known deposits in the Argentine are given. Microscopic studies, chemical analysis, and x-ray-diffraction investigation are included, and finally age calculations are discussed. (auth)

9825

GEOLOGY OF THE JOMAC MINE, WHITE CANYON AREA SAN JUAN COUNTY, UTAH. Albert F. Trites, Jr. and George A. Hadd. U. S. Geol. Survey Bull. 1046-H, 1958. 21p. and 3 illus. $0.75.

The Jomac mine workings consist of two adits connected by a crosscut. Sedimentary rocks exposed in the Jomac mine area are of Permian to Late Triassic age and have combined thickness of more than 1,700 feet. An ancient stream channel, from 200 to 400 feet wide and about 4 feet deep, enters the mine area from the southwest, swings abruptly northwest near the mine workings and continues to the northern tip of Jomac Hill. This channel, including depressions that apparently were scoured into its floor, was cut into the upper beds of the Moenkopi formation and filled by Chinle and Shinarump sediments. A tributary channel may have joined it from the southeast at a point near the mine workings. Jomac Hill is on the crest of a southwest-plunging fold on the west flank of a larger syncline. The area surrounding the hill is broken by intense faulting, but no faults were noted in the vicinity of the mine. The major fractures in the mine workings strike N. 70° to 80° E. and dip steeply. Secondary steeply dipping fractures strike N. 40° to 60° E., and N. 10° E. to N. 10° W. The fractures are believed to be related to the anticlinal structure rather than to the faults. Most of the uranium is contained in coal in association with jarosite and gypsum in sandstone, conglomerate, or sandy siltstone near the base of the Shinarump conglomerate. Uranium occurs in metazeunerite, a fibrous green secondary mineral, in an unidentified fibrous yellow mineral, and in an unidentified

massive yellow mineral. Secondary copper minerals, including malachite, azurite, and chalcanthite, occur locally with the uranium minerals. Principal ore guides at the Jomac mine are channels, scours at the bottom of these channels, coal-bearing sandstone or conglomerate at the base of the Shinarump conglomerate, coal, and jarosite. (auth)

Metals and Metallurgy

Refer also to abstracts 10248, 10249, 10250, 10251, 10252, 10254, 10255, and 10256.

9826 AERE-X/R-1043

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England; and Gt. Brit. National Physical Lab., Teddington, England.

A SURVEY OF THE URANIUM–NICKEL SYSTEM. Report No. 67. Sept. 13, 1952. Decl. Apr. 1, 1958. 18p.

The liquidus of the uranium–nickel system takes the form of two eutectic troughs, the one between U_6Ni and a compound approximately U_7Ni_9 melting at 740°C and containing about 10.5 wt. % (33 atomic wt. %) nickel, the other between UNi_5 and nickel melting at 1110°C and containing about 71 wt. % (91 at. wt. %) nickel, separated by a peak which rises to 1305°C the melting point of UNi_5. Compounds are formed by peritectic reactions–U_6Ni at 790°C; compounds approximately of compositions U_7Ni_9 and U_5Ni_7 at 785 and 820°C, respectively; UNi_2 at 785°; and a compound containing 78 to 79 at. % nickel at 1290°C. Another compound occurs containing approximately 77 at. % Ni. The exact ranges of composition and formulas of the compounds have not been determined in this investigation and the formulas suggested are adopted for the sake of convenience. The compounds U_6Ni, UNi_2 and UNi_5 have been established elsewhere by x-ray methods. The solid solubility of nickel in uranium is nearly 0.5 wt. % (2 at. %) at 790°C and decreases with the temperature. The solid solubility of uranium in nickel is about 0.75 wt. % (0.18 at. %) at 1000°C and decreases with the temperature. (auth)

9827 AFOSR-TN-57-366

Illinois. Univ., Urbana; and Office of Scientific Research, Baltimore.

THE MECHANICAL PROPERTIES OF METALS AT LOW TEMPERATURES. H. M. Rosenberg. Oct. 15, 1957. 33p. Contracts AF-18(600)-13 and AF-18(603)-22. (AD-136655).

A review is presented of low temperature techniques as applied to the systematic study of some of the mechanical properties of metals. The strength is usually enhanced even down to the temperature of liquid He, 4.2°K. Elasticity, creep, fatigue, and internal friction are studied. (J.E.D.)

9828 NP-6727

Battelle Memorial Inst., Columbus, Ohio.

RESEARCH AND DEVELOPMENT OF PROCEDURES FOR THE JOINING OF SIMILAR AND DISSIMILAR HEAT-RESISTING ALLOYS BY ULTRASONIC WELDING. Progress Report [for] January 1 to March 31, 1958. N. E. Weare, R. E. Monroe, J. N. Antonevich, and D. C. Martin. Apr. 15, 1958. 31p. Contract AF33(616)-4352.

Studies of the mechanism of bonding in ultrasonic welding are continued. The effects of tip displacement and clamping pressure in ultrasonic welding of 1100 aluminum were investigated. Initial studies of the titanium-to-stainless steel system are reported. (For preceding period see NP-6575.) (T.R.H.)

9829 NRL-5123

Naval Research Lab., Washington, D. C.

THEORY OF CREEP OF DISPERSION-HARDENED ALLOYS. J. Weertman. Feb. 27, 1958. 10p.

Creep equations have been derived for dispersion-hardened alloys. Following Schoeck, it is assumed that the rate-controlling process is the climb of dislocations over second-phase particles. At low stresses a first-power stress dependence is found; at intermediate stresses a fourth-power dependence; and at high stresses an exponential stress dependence. (auth)

9830 NRL-5124

Naval Research Lab., Washington, D. C.

IRON–CHROMIUM–ALUMINUM ALLOYS. J. E. Srawley. Feb. 28, 1958. 19p.

Alloys containing up to 25% chromium and 11% aluminum were produced by vacuum melting and hot worked by forging. Tensile properties at room and elevated temperatures were determined, and their resistance to oxidation in air and attack by the combustion products of residual fuel oils was studied. Alloys containing about 5% aluminum and 25% chromium appear to offer excellent prospects of improved service as boiler-tube support materials when compared with type 310 stainless steel, which is commonly used. It has been shown in an earlier report that application of aluminum coatings to the type 310 steel offered little prospect of improved life. The vacuum induction melting process as applied to these alloys was studied. The exclusion of air during melting and pouring is important in controlling the cleanliness of the product, but the level of dissolved oxygen is controlled by the aluminum content and is so low that prior deoxidation with hydrogen or carbon cannot affect it. The possibilities of control of carbon and nitrogen require further study. (auth)

9831 NYO-7920

Aeroprojects, Inc., West Chester, Penna.

ULTRASONICALLY ACCELERATED DISSOLUTION OF CORROSION-RESISTANT METALS. J. L. Straughn, M. L. Bromberg, and W. B. Tarpley. Mar. 1958. 83p. Contract AT(30-1)-1836. $13.80(ph OTS); $4.80(mf OTS).

Ultrasonic energy was applied to the dissolution of candidate heterogeneous reactor fuel-element cladding metals presently difficult to dissolve, with the objective of increased dissolution rate and decreased concentration of corrosive dissolvent components. Significant increases in dissolution rates were achieved with austenitic stainless steels, Zircaloy-2, and molybdenum, and dissolution was promoted in reagents that do not normally attack these metals. Three basic approaches to ultrasonically accelerated dissolution were investigated: bulk activation of a solution, activation of a dissolving surface in close proximity to the ultrasonic coupler, and direct activation in which the metal itself is flexurally vibrated in a dissolving solution. Studies with pressurized systems demonstrated the important role of cavitation in both bulk-activation and close-proximity treatment, since dissolution rate was significantly reduced as cavitation was suppressed. The close-proximity approach was the more effective, and Zircaloy-2 dissolved in 4 M HNO_3–13.5 M H_2SO_4 solution by this technique showed a fourfold rate increase over non-ultrasonic dissolution. Greatest improvement in dissolution was achieved by direct ultrasonic activation of the metal. In a mixture of 4 M HNO_3–0.1 M HCl,

dissolution of Type 304 stainless steel was increased approximately 200-fold to an acceptable rate of 4 mg/cm^2/min, whereas a non-ultrasonic control showed negligible dissolution in this reagent. The possibilities of reduced equipment corrosion and concentration of corrosion attack as desired have important implications. Prototype all-metal dissolvers for successful containment of dissolvents were constructed, the vibratory energy being introduced into corrosive environments without mechanical motion and its concomitant sealing difficulties. (auth)

9832 TML-46C (Rpt: UNCLASSIFIED)
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
DEPARTMENT OF DEFENSE TITANIUM SHEET-ROLLING PROGRAM. Status Report No. 3. C. R. Simcoe. May 16, 1958. 54p.

Progress of the Ti sheet-rolling program from the middle of 1957 to Jan. 1, 1958, is reported. Phases of the work are reported from the Mallory-Sharon Metals Corp., Rem-Cru Titanium, Inc., Titanium Metals Corp. of America, Lockheed Aircraft Corp., and Battelle Memorial Inst. Data are tabulated on the heat treatment and mechanical properties of the following alloys: Ti–6Al–4V, Ti–16V–2.5Al, Ti–4Al–3Mo–1V, and Ti–6Mo–3Al. (J.E.D.)

9833 WADC-TR-57-678
Westinghouse Electric Corp. Aviation Gas Turbine Div., Kansas City, Mo.
STUDIES AND COMPARISON OF THE PROPERTIES OF HIGH TEMPERATURE ALLOYS MELTED AND PRECISION CAST BOTH IN AIR AND IN VACUUM. Period Covered: April 13, 1956 to October 13, 1957. Milo J. Stutzman. Dec. 26, 1957. 112p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE METALS AND ALLOYS. Contract AF33(616)-3468. (AD-151035).

An investigation was made of the potentialities for improvement of the mechanical properties at elevated temperature of heat-resisting alloys by varied practices of melting and investment casting. Two cobalt and two nickel base alloys were prepared under the following casting conditions: Stellite 31 was melted and investment cast in air and in vacuum, with an argon atmosphere for pouring. He 1049 was melted and investment cast in air and in vacuum, with an argon atmosphere for pouring. Utimet 500 was melted and investment cast in vacuum with and without additions of zirconium and boron. Guy Alloy was melted and investment cast in vacuum and in argon. The effects of melting and casting procedures upon the gas (hydrogen, oxygen, oxygen and nitrogen) contents, the tensile properties at room and elevated temperatures, the stress-rupture properties in the range of 1350 to 1800°F, and the oxidation resistance to air at constant temperature of 2000°F and intermittent exposure to air at room temperature and 2000°F were studied. The data obtained failed to support conclusions applicable to the four alloys under investigation. Tests of specimens of one alloy failed to substantiate data obtained from other tests for related properties. The data must be evaluated for each alloy with close correlation to service conditions for design applications. (auth)

9834 WAL-TR-401/285
Watertown Arsenal Lab., Mass.
THE EFFECT OF CERIUM ON THE HEAT TREAT RESPONSE OF PRECIPITATION-HARDENING TITANIUM ALLOYS. Ralph H. Hiltz, Jr. Apr. 1958. 26p. DA Project 593-32-003.

A study was made of the effect found in combining the weak precipitation-hardening alloys of titanium, Ti–Ag, Ti–Cu, and Ti–Si, with the more intense precipitation-hardening but hot-short Ti–Ce alloys. Metallography, x-ray diffraction, and hardness testing were used for the study. Aging of the alloys was performed in the temperature range 200 to 600°C for times from ½ to 5 hr. The three ternary alloys Ti–Ag–Ce, Ti–Cu–Ce, and Ti–Si–Ce showed appreciable precipitation-hardening response. The Ti–Si–Ce ternary showed a double peaking of hardness with aging. A portion of the response in this alloy was due to precipitation of elemental cerium, however, which indicates a hot-short material. The addition of cerium to the Ti–Ag alloy moved peak hardness to shorter times, and maximum hardness to a lower temperature. There is no alleviation of the rapid aging and overaging cycle characteristic of the binary silver alloy, and control of the hardening reaction is difficult. The alloy of titanium with copper and cerium showed pronounced precipitation hardening and a slow overaging reaction. This alloy shows promise of being suitable for commercial application. (auth)

9835 WAPD-FE-13
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
EMBRITTLEMENT OF ZIRCALOY 2 CLADDING MATERIAL AS A RESULT OF THE OXIDATION OF THE URANIUM CORE. Earl L. Richards. June 9, 1953. Decl. Apr. 24, 1958. 3p. $1.80(ph OTS); $1.80(mf OTS).

Photomicrographs serve to illustrate embrittlement of Zircaloy-2 cladding as a result of the oxidation of the uranium core during corrosion testing in water at 650°F. (A.C.)

9836 WAPD-ZH-6
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ZIRCONIUM HIGHLIGHTS, APRIL 1958. 22p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The preparation of Zircaloy-2 surfaces for corrosion exposure consists of the chemical removal of one to two mils of surface metal by bright etching in an aqueous solution of nitric and hydrofluoric acid. Experiments were initiated to determine the effects of substituting sulfuric acid for the nitric acid on pickling and corrosion behavior. A satisfactory metallographic technique for identification of the zirconium hydride phase after various thermal treatments was developed to determine the hydrogen content in Zircaloy-2. The hydrogen is removed by vacuum annealing at 1450°F. The properties of cast Zircaloy-2 are being investigated in order that cast components might be used for reactor application. Stress-rupture tests of atmosphere-melted, extruded, and annealed Zircaloy-2 were performed in helium at 600, 700, and 800°F. Rupture values, minimum creep rates, and time to various amounts of total deformation are shown as a function of applied stress. (For preceding period see WAPD-ZH-5.) (W.D.M.)

9837 AEC-tr-3197
METHOD OF ULTRASONIC CONTROL OF WELDED SEAMS. S. T. Nazarov and Iu. P. Panov. Translated from Zavodskaya Lab. 23, 305-8(1957). 9p.

A method has been developed for the ultrasonic control of the quality of a welded joint which makes it possible to determine the nature of the defect directly from the readings of the apparatus and to increase the ojectivity of the measurement. (J.E.D.)

9838 AEC-tr-3238
METALLOGRAPHY—ON THE EXISTENCE OF A

PLASTIC DEFORMATION OF IRON DURING THE $\alpha \rightleftharpoons \gamma$ TRANSFORMATION. (Metallographie—Sur l'existence d'une Déformation Plastique du fer au Cours de la Transformation $\alpha \rightleftharpoons \gamma$.) M. Pierre Lehr. Translated from Compt. rend. 244, 77-80(1957). 7p.

The existence of plastic deformation of iron during the $\alpha \rightleftharpoons \gamma$ transformation was confirmed by a micrographic study. The characteristics of this deformation are those of a true hot extrusion of the metal. (auth)

9839

MEASUREMENT OF THE VISCOSITY OF METALLIC WIRES BY A RESONANCE METHOD. C. Sălceanu and M. Zăgănescu. Acad. rep. populare Romine Baza cercetări stiint. Timisoara Studii cercetări stiint. Ser. I, 2, 59-63(1955). (In Romanian)

The coefficient of viscosity (Honda coefficient) was measured, by a resonance method, for wires of copper and aluminum. The conditions on which the wires should be dependent so that this coefficient remains independent of the diameter of the wire are defined. The measurements were made at atmospheric pressure. (tr-auth)

9840

CAST STEEL ALLOYED WITH COPPER. Gh. Ilin, V. Olteanu, A. Ianu, and I. Obradovici. Acad. rep. populare Romine Baza cercetări stiint. Timisoara Studii cercetări stiint. Ser. I, 2, 235-8(1955). (In Romanian)

The results obtained from investigations on the production of alloys of steel and copper are presented. The rupture strength, yield point, elongation, compression, elasticity, and structure were determined for alloys receiving different thermal treatments. (tr-auth)

9841

STUDIES OF ALUMINIUM–RICH ALLOYS WITH THE TRANSITION METALS MANGANESE AND TUNGSTEN. I. THE CRYSTAL STRUCTURE OF ϵ(W–Al)–WAl_4. J. A. Bland (Cavendish Lab., Cambridge, Eng.) and D. Clark (Royal Aircraft Establishment, Farnborough, Eng.). Acta Cryst. 11, Pt. 4, 231-6(1958) Apr. 10.

The crystal structure of WAl_4 has been determined with moderate accuracy. The space-group symmetry was found to be Cm, and precision lattice parameters were measured as a = 5.272, b = 17.771, c = 5.218 A, $\beta = 100° 12'$. The 'heavy atom' technique was used to find the approximate structure, and F_0 syntheses were used in the refinement. The atomic arrangement is noncentrosymmetrical and the cell contains 30 atoms mostly confined to eight well-defined layers perpendicular to the b axis. There is a close similarity between the unit cells and structures of WAl_4, $MnAl_6$, and δ(Mn–Al)–Mn_4Al_{11}. (auth)

9842

STUDIES OF ALUMINIUM-RICH ALLOYS WITH THE TRANSITION METALS MANGANESE AND TUNGSTEN. II. THE CRYSTAL STRUCTURE OF (Mn–Al)–Mn_4Al_{11}. J. A. Bland (Cavendish Lab., Cambridge, Eng.). Acta Cryst. 11, Pt. 4, 236-44(1958) Apr. 10.

Crystals of the triclinic alloy phase δ(Mn–Al) with an ideal formula Mn_4Al_{11} have been isolated from a ternary melt containing zinc. The space-group symmetry was found to be $P\bar{1}$, and the precision lattice constants measured as a = 5.092, b = 8.862, c = 5.047 A, $\alpha = 85° 19'$, $\beta = 100° 24'$, $\gamma = 105° 20'$. The approximate structure has been determined by direct methods and has been refined by difference syntheses. Abnormally short distances occur in the same orientation as in $MnAl_6$, relative to the transition metal atom. The relationship between the crystal structures of δ(Mn–Al), $MnAl_6$ and WAl_4 is considered in terms of similarly shaped co-ordination groups and well defined layers of atoms; the pattern of sites in each layer is derived from a crumpled 5-connected net. Related structures in the Fe–Al and Co–Al systems are discussed. (Auth)

9843

AN ESTIMATION OF THE DIAGRAM OF FREE ENTHALPY OF THE TERNARY SYSTEM Fe–Mn–Si AT 1600°K. Étienne Bonnier. Compt. rend. 246, 2617-19 (1958) May 5. (In French)

The diagrams of the binary and ternary phases of the system Fe–Mn–Si have served as the experimental basis of the estimation of the activity curves of the constituents, based on the phase relations, on certain characteristics of regularity of the solutions, and on the Gibbs-Duhem law. (tr-auth)

9844

EFFECTS OF CHROMIUM, MOLYBDENUM, AND TUNGSTEN ON SELF-DIFFUSION OF IRON IN α SOLID DILUTED SOLUTIONS. I. B. Borovskii, K. P. Gurov, and Yu. G. Miller (Baikov Inst. of Metallurgy). Doklady Akad. Nauk S.S.S.R. 118, 280-3(1958) Jan. 11. (In Russian)

9845

RECRYSTALLIZATION DIAGRAM OF TANTALUM. E. M. Savitskii, M. A. Tylkina, and I. A. Tsyganova. Doklady Akad. Nauk S.S.S.R. 118, 720-2(1958) Feb. 1. (In Russian)

The temperature of the Ta recrystallization point decreases with the increase of deformation from 1300 to 1200° (with 2.6% deformation the recrystallization begins at 1300°, with 10 to 34% at 1275°, with 50 to 68% at 1250°, and with 84% and more at 1200°). The optimum annealing conditions producing a fine-grain, polyhedral Ta of high mechanical quality were found at temperatures of 1300 to 1400°. (R.V.J.)

9846

FERROMAGNETIC PHASE IN HIGH MELTING POINT AUSTENITE STEEL. V. Z. Tzeitlin (Central Research Inst. of Machine Building). Fiz. Met. i Metalloved. 5, 36-43(1957). (In Russian)

It is shown that the appearance of the ferromagnetic phase reduces the heat resistance of austenite steel 14-14 (14% Ni and 14% Cr). The rate of the ferromagnetic phase appearance and disappearance increases with increase of temperature. The ferromagnetic phase usually appears during the concentration changes in solid solution caused by carbide formation, and it disappears during the diffusion processes which equalize the concentrations. A practical suggestion is offered for an annealing process conducive to smaller ferromagnetic phase content. (tr-auth)

9847

DETERMINATION OF THE DIMENSIONS OF THE CARBIDE PARTICLES DURING THE PROCESS OF TRANSFORMATION OF CHROMIUM CARBIDES FROM ONE STATE INTO THE OTHER DURING TEMPERING OF HARDENED STEEL. Z. K. Kos'ko. Fiz. Metal. i Metalloved. 5, No. 1, 179-82(1957).

Depending on the carbon and chromium content, carbon steels in the equilibrium state may contain carbide with a rhombic lattice $(Fe,Cr)_3C$, with up to 12 to 15% chromium; carbide with a hexagonal lattice $(Cr,Fe)_7C_3$, with at least 33% Cr; and carbide with a cubic lattice $(Cr,Fe)_{23}C_3$, with at least 59% Cr. An investigation was made of the changes in the dimensions of the carbide particles during transformation of carbide of one composition into carbide of another composition. The di-

mensions of the carbide crystals were determined by x-ray methods on carbide powders produced from steel by electrolytic dissolution. A steel containing 0.7% C, 0.1 to 0.3% Cr, 0.25 to 0.40% Mn, and no more than 0.02% of either S or P was used. The changes in the dimensions of carbide crystals were determined as a function of the tempering temperature. At low tempering temperature the carbide crystals did not grow. For instance, the crystals $(Fe,Cr)_3C$ did not grow at tempering temperatures up to 450 or 500°C, and in the temperature range 500 to 550°C the dimensions of the crystallites became even smaller. However, an increase of the tempering temperature above 550°C causes a growth of the crystals. A decrease in size of the crystals was observed for the carbide $(Cr,Fe)_7C_3$ at tempering temperatures of 550 to 600°C. (J.S.R.)

9848

TECHNETIUM. V. Baran. Jaderna Energie 4, 73-80 (1958). (In Czech.)

A survey is given of the physical and chemical properties of technetium. 52 references. (R.V.J.)

9849

THE PROTECTIVE VALUE OF TIN–NICKEL ALLOY DEPOSITS ON STEEL. F. A. Lowenheim (Metal & Thermit Corp., Rahway, N. J.), W. W. Sellers (International Nickel Co., New York), and F. X. Carlin (International Nickel Co., Bayonne, N. J.). J. Electrochem. Soc. 105, 338-46(1958) June.

Outdoor exposure tests of the comparative value of the Sn–Ni alloy and conventional Ni/Cr deposits on steel, with and without a copper undercoat, are reported. It is shown that Sn–Ni is comparable in protective value to Ni/Cr, not quite so good in marine but superior in industrial atmospheres. The type of corrosion behavior of the two deposits differs considerably. In general, the protective value of the Sn–Ni deposit is of a high order. (auth)

9850

REFRACTORY METALS: TUNGSTEN, TANTALUM, COLUMBIUM, AND RHENIUM. J. W. Pugh (General Electric Co., Cleveland, Ohio). J. Metals 10, 335-9 (1958) May.

An analysis of the status and prognosis of the refractory metals Ta, Nb, W, and Re with respect to high-temperature applications is reviewed. Tensile properties, creep-rupture strength, oxidation behavior, and oxidation resistant alloys and coatings are discussed. (J.E.D.)

9851

A COLUMBIUM PRIMER. Chester T. Sims (Battelle Memorial Inst., Columbus, Ohio). J. Metals 10, 340-5 (1958) May.

The occurrence and economics, extraction, vacuum purification, alloying behavior, fabrication, mechanical properties, and oxidation of Nb are discussed. High-temperature applications in atomic energy and missile or jet engine applications are reviewed. (J.E.D.)

9852

HEATS OF FORMATION OF α-PHASE SILVER–CADMIUM ALLOYS. Raymond L. Orr, Alfred Goldberg, and Ralph Hultgren (Univ. of California, Berkeley and U. S. Naval Postgraduate School, Monterey, Calif.). J. Phys. Chem. 62, 325-7(1958) Mar.

Heats of formation at 308°K were determined for a series of alloys covering the alpha phase of the cadmium–silver alloy system. The data are well represented by a regular solution equation with an added short-range order term except near the alpha-phase boundary where there is a positive energy effect. (auth)

9853

METALLURGICAL DEFECTS IN HIGH SPEED STEELS. E. Niesielski. Metallurgia 57, 233-46(1958) May.

Following a brief reference of the requirements of a cutting took, and of the control necessary to ensure their being met, the author describes the various defects—apart from common defects such as piping, non-metallic inclusions, etc —which arise in high-speed steels during steel making, heat treatment, and tool processing. (auth)

9854

DIRECT OBSERVATION OF THE STRAIN FIELD PRODUCED BY COHERENT PRECIPITATED PARTICLES IN AN AGE-HARDENED ALLOY. R. B. Nicholson and J. Nutting (Cambridge Univ., Eng.). Phil. Mag. 3, 531-5 (1958) May.

Transmission electron micrographs of aged aluminum–4% copper foils have shown unusual contrast near precipitated particles. This is interpreted in terms of Bragg diffraction from regions distorted by elastic coherency strains between the precipitate and the matrix. (auth)

9855

THE METALLURGY OF BERYLLIUM. I. E. Newnham (C.S.I.R.O., Melbourne). Research (London) 11, 185-91(1958) May.

Mineral concentration, chemical extraction and purification, and reduction and fabrication are some of the urgent problems of Be metallurgy requiring the attention of research workers. The danger of Be-induced health hazards as a serious deterrent to economical exploitation of the metal and its compounds is discussed. (J.E.D.)

9856

ELECTROCHEMICAL PREPARATION OF ALLOYS OF NICKEL WITH MOLYBDENUM OR TUNGSTEN IN AMMONIUM HYDROXIDE ELECTROLYTE. T. F. Frantsevich-Zabludovskaya and A. I. Zayats. Zhur. Priklad. Khim. 31, 234-40(1958) Feb. (In Russian)

It is shown that electrolytic precipitation of nickel–molybdenum and nickel–tungsten alloys from oxy-acid-free ammonium hydroxide is possible. Analysis was made of the effects of electrolyte composition and conditions of electrolysis on the content and yield from current. (R.V.J.)

PHYSICS

Refer also to abstracts 10258 and 10268.

9857 57-RL-1836

General Electric Co. Research Lab., Schenectady, N. Y.

THEORY OF DIFFUSION-LIMITED PRECIPITATION. F. S. Ham. Nov. 1957. 51p.

A simple theory for diffusion-limited general precipitation from a supersaturated solution upon an array of particles is described. The time-dependence of the unprecipitated fraction of the excess solute for small spherical, spheroidal, and cylindrical particles is calculated. This fraction has the form $\exp(-bt^n)$ for small t. If the particles grow from initially negligible dimensions with constant eccentricity, and the growth is entirely diffusion-limited, we find $n = 3/2$ for all spheroids, including rods and disks as well as spheres. This contrasts with earlier evaluations, which gave $n = 5/2$ for disks and $n = 2$ for rods and which are incorrect.

It is found that n = 1 for cylindrical particles. Also, n is 1 for small disks and rods, of finite initial dimensions, that remain highly eccentric and do not alter their longer dimensions appreciably during growth. Regardless of particle shape, the unprecipitated fraction is given approximately by [G exp(-at)] when the fraction is less than ½. An exact solution is also given of the time-dependent diffusion equation for the growth of a spheroidal particle in an infinite medium, and it is shown under strictly diffusion-limited conditions that the particle grows with constant eccentricity and that its dimensions are proportional to $\sqrt{t}$. (auth)

9858 BRL-750

Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE KIRKWOOD-BRINKLEY THEORY OF THE PROPAGATION OF SPHERICAL SHOCK WAVES, AND ITS COMPARISON WITH EXPERIMENT. Ray Makino. Apr. 1951. 62p. Project No. TB3-0112J.

The Kirkwood-Brinkley theory of spherical shock wave propagation has been employed to predict peak pressures and impulses under conditions of reduced atmospheric pressure. Although agreement with experiment is good under sea level conditions, discrepancies between prediction and experiment are found at reduced atmospheric pressures. The possibility is suggested that one of the assumptions made by Kirkwood and Brinkley, involving the conditions at the explosive surface, may be capable of further refinement. (auth)

9859 NACA-TN-4276

Ames Aeronautical Lab., Moffett Field, Calif.

AN APPROXIMATE ANALYTICAL METHOD FOR STUDYING ENTRY INTO PLANETARY ATMOSPHERES. Dean R. Chapman. May 1958. 102p.

The complete pair of motion equations for entry into an exponential atmosphere is reduced to an ordinary, nonlinear differential equation of second order by introducing a certain mathematical transformation. This differential equation includes terms representing the gravity force, centrifugal force, lift force, drag force, and vertical acceleration. Solutions obtained for different types of entry are universal in the sense that a single solution determines the motion and heating of a vehicle of arbitrary weight, dimensions, and shape entering an arbitrary planetary atmosphere. Study is made of the decelerations, heating rates, and total heat absorbed for entry into Venus, Earth, Mars, and Jupiter. (auth)

9860 NYO-7924

Aeroprojects, Inc., West Chester, Penna.

ULTRASONICALLY PRODUCED DISPERSIONS OF THORIUM BISMUTHIDE IN MOLTEN BISMUTH. M. L. Bromberg, J. G. Thomas, and W. B. Tarpley. Mar. 1958. 29p. Contract AT(30-1)-1836. $4.80(ph OTS); $2.70(mf OTS).

Ultrasonic energy was applied to the production of finely dispersed thorium bismuthide of potential use in the blanket preparation for the LMFR. A controlled-atmosphere ultrasonic-treatment furnace was assembled for operation at temperatures up to 1200°C, taking advantage of previously developed principles of ultrasonic furnace construction. Using 5% thorium–95% bismuth systems, it was found that when ultrasonic vibration was applied during cooling from complete solution temperature (1050°C) to 450°C, vibratory energy suppressed the normal precipitation of one-centimeter-long thorium bismuthide platelets and produced more nearly equiaxed particles of a size generally less than 50 μ in diameter. When applied to melts containing large platelets formed by cooling under the above conditions without applied ultrasonics, vibratory energy applied isothermally at 450 to 500°C fractured the platelets into generally equiaxed particles smaller than 100 μ. Increased treatment time under these conditions appeared to increase the effectiveness of particle breakup. (auth)

9861 ORNL-2260

Oak Ridge National Lab., Tenn.

AN INVESTIGATION OF THE RESONANT PROPERTIES OF SHORT EXPONENTIALLY AND LINEARLY TAPERED LINES. M. R. Donaldson. May 26, 1958. 176p. Contract W-7405-eng-26. $3.00(OTS).

Cyclotron problems are emphasized. The exponentially and linearly tapered lines are chosen for study with emphasis on the linear line since it can be fabricated practically. The object of the investigation is two-fold: first, to develop the theory of the linear line and to extend the theory of the resonant properties of the exponential line with emphasis on the power and tuning properties of both lines; second, to provide unified results comparing the resonant properties of the exponential, linear, and uniform lines. The classical approach employing the method of ordinary transmission line theory is used to develop analytical expressions for both of the tapered lines. For simplicity, emphasis is placed upon lossless lines. The resulting voltage and current expressions for the exponential line are in terms of exponential and circular functions. For the linear line, the expressions for voltage and current are in terms of Bessel functions of the first and second kinds of orders zero and one. Experimental data are presented to verify the mathematical results. Various illustrations of current, voltage, power, and input impedance properties are presented for the two tapered lines. Composite curves are provided to show a concise comparison of the similarities and differences among the exponential, linear, and uniform lines. In addition, the tuning properties of the tapered lines are discussed. It is shown that quarter-wave linear (and exponential) lines can be designed which will operate at a given frequency and which will be either longer, or shorter, than a uniform line operating at the same frequency. It is shown that quarter-wave linear (or exponential) lines, whose nominal characteristic impedance decreases from the shorted end toward the open end, require less power to obtain a given voltage at the open end than the comparable uniform line (where both lines are operating at the same frequency and have the same nominal characteristic impedance at the open end). With respect to tuning, it is shown that linear (and exponential) lines add considerable design flexibility, and can be used advantageously, in the solution of wide-range tuning problems in which the line is the variable parameter. The theory of the linear line is illustrated by two examples, one of which was the cyclotron problem that motivated this research. (auth)

9862 PR-P-36

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PHYSICS DIVISION PROGRESS REPORT [FOR] OCTOBER 1, 1957 TO DECEMBER 31, 1957. 80p. (AECL-567). $2.00(AECL).

The study of the decay scheme of Bi^{208} is continuing. The only mode of decay identified is K-electron capture to the 2.62-Mev first-excited state of Pb^{208}. The measurements of the absorption ratios for the $Na^{23}(n,\gamma)Na^{24}$ reaction have been completed. The Fong-Newton approach has been re-evaluated using improved nuclear

level densities and performing full integrations over the distributions of kinetic and excitation energies of the fragments for all modes in the fission of U^{235} with thermal neutrons. It is confirmed that the predictions of yield and kinetic energy distributions are in violent disagreement with observation. The study of longitudinal polarization of beta rays from P^{32}, Y^{90}, Pr^{144}, Au^{198}, and Bi^{210} by the Møller scattering technique has continued. The experimental results are equal to or somewhat less than that expected for full-v/c polarization. Following the measurements of the 110-v a-c line frequency stability, a tuning fork frequency standard with a stated accuracy of one part in 10^5 has been installed. This unit is used in conjunction with a 60-cycle power amplifier to drive the synchronous motors of two AEP auto control units, one a master control for the $4\pi\ \beta$ coincidence unit, the other is used for measurements with the high pressure 4π counter. A calculation has been performed to determine the width and average value of the fission-fragment excitation energy distribution that is required to give the observed neutron multiplicity distribution. For U^{235} masses 95-151 a half-width of 12.9 Mev and average total excitation of 17.7 Mev, and for Cf^{252} masses 107-145 a half width of 17.7 Mev and average total excitation of 29.8 Mev were found. The rates of change of $<\nu>$ with excitation energy were found to be 0.165 and 0.148 Mev^{-1} for U^{235} and Cf^{252}, respectively. Gamma rays from the long-lived isomer of Ho^{166} were found at 420 and 540 Mev. A decay scheme is presented. A brief study was made of the protons from the reaction $N^{14}(He^3,p)O^{16}$, and two groups were observed corresponding to an excitation near 11 Mev in O^{16}. The measured values correspond to excitations of 11.22 ± 0.10 Mev and 11.10 ± 0.10 Mev which may be somewhat high owing to thick target effects. Two resonances in the reaction $C^{14}(\alpha,\gamma)O^{18}$ were discovered at alpha-particle energies of 1.13 and 1.78 Mev corresponding to levels in O^{18} at 7.12 and 7.62 Mev. Measurement of the branching ratio of the radiation from the reaction $O^{16}(He^3,p)F^{18}$ shows that the F^{18} excited state 3.1 Mev de-excites to the ground state 25% of the time and to the 0.94 Mev state 75% of the time. The wavelength distribution of neutrons scattered from liquid helium at angles of 90° and 45.5° for liquid helium at temperatures down to 1.25°K has been measured. The neutron diffraction pattern of solid argon at 4.2°K was measured and the lattice parameter (5.257 ± 0.02 A), density (1.83 g/cc), and separation of nearest neighbors (3.72 A) were calculated. The analysis of the low-energy U^{235} cross sections for neutrons by the complete Wigner-Eisenbud theory was completed. The theoretical calculations of the total and the partial cross sections agree with the experimental cross sections to within one or two percent everywhere up to a neutron energy of 2 ev. (For preceding period see PR-P-35.) (W.D.M.)

9863 SCR-10

Sandia Corp., Albuquerque, N. Mex.

ACCEPTANCE SAMPLING CRITERIA FOR THE CONSUMER. Allen F. Hurford. Aug. 8, 1957. 5p. Contract AT-(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

9864 SCTM-81-58(51)

Sandia Corp., Albuquerque, N. Mex.

COMPARISON BETWEEN HAND-INTEGRATION AND EQUAL-AREA METHODS FOR PRESSURE MODEL DATA REDUCTION. R. E. Tate. May 15, 1958. 12p. Contract [AT(29-1)-789]. $3.30(ph OTS); $2.40(mf OTS).

A wind-tunnel pressure test was run, and some of the data were reduced by both the hand-integration and the equal-area methods to obtain local load coefficients. It is shown by comparison that the equal-area method is much simpler than hand integration and produces satisfactory results. Force data from another wind-tunnel test are presented to show the agreement between force and pressure measurements to obtain total loads. (auth)

9865 SCTM-157-58(14)

Sandia Corp., Albuquerque, N. Mex.

HYBRID TRANSMISSION LINES. Charles W. Harrison, Jr. May 15, 1958. 21p. Contract AT(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

A general method is advanced for determining the input impedance of dual or multiple wire unconventional transmission lines terminated in an arbitrary way. It is shown that an antenna mode exists in a transmission line which is driven at one end and terminated in an arbitrary impedance at the other end provided a lumped impedance is connected in series with one wire. If there is no lumped series impedance element, only a transmission line mode will exist in the line, no matter how complicated the configuration of wires. (auth)

9866 SCTM-202-58(15)

Sandia Corp., Albuquerque, N. Mex.

A STUDY OF A COMPLEMENTARY SYMMETRICAL POWER SWITCHING CIRCUIT. Glenn S. Mills. May 30, 1958. 110p. Contract AT(29-1)-789. $16.80 (ph OTS); $5.70(mf OTS).

An analysis of a symmetrical, complementary, power-switching circuit employing complementary power transistors is given. A d-c analysis is made for the bistable states. Also described is a voltage regulation and bias circuit which improves stability and contributes to the protection of the transistors. The problem of switching transients was investigated, and empirical results are presented to support theoretical considerations. A new triggering method is proposed to utilize the bilateral characteristic of a transistor. Applications of the circuit are suggested for controlled-frequency and self-triggering modes of operation. A method and analysis for self triggering is presented. The advantages of this power switching circuit over other methods of low-frequency moderate power generation are enumerated. (auth)

9867 UCRL-5232

California. Univ., Livermore. Radiation Lab.

A BIBLIOGRAPHY ON FACTORS EFFECTING THE MOTION OF THE ARTIFICIAL EARTH SATELLITE. Frederick E. Frost, comp. May 20, 1958. 6p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

This bibliography on the motion of the artificial earth satellite consists of 44 references from the following sources: Aeronautical Engineering Review, 1956–Apr. 1958; Astronautica Acta, 1956–Jan. 1958; Journal of the British Interplanetary Society, 1956–1958; Index Aeronauticus, 1956–Apr. 1958; Jet Propulsion, 1956–Apr. 1958; and U. S. Library of Congress List of Russian Accessions, 1956–Mar. 1958. (J.E.D.)

9868 AEC-tr-3229

THERMODYNAMIC STUDIES AT LOW TEMPERATURES. I. MEASUREMENT OF TEMPERATURES BETWEEN 12 AND 300°K. P. G. Strelkov, A. S. Borovik-Romanov, and M. P. Orlova. Translated by Lydia Venters from Zhur. Fiz. Khim. 28, 345-52(1954) 15p.

The technique of thermometer calibration according to international scale was developed, along with a technique of thermometer calibration based on the boiling point of naturally occurring hydrogen as determined by use of a gas thermometer. A simple method for con-

struction of scale for platinum resistance thermometer, based on differences of specific resistance, independent of temperature, of various chemically pure platinum varieties was developed. By use of these pure varieties of platinum temperatures from 12 to 300°K were measured with deviations of 0.03 to 0.04°K and a sensitivity of 5×10^{-4}°K. (J.E.D.)

9869 AEC-tr-3235

POLYTROPIC PRESSURE OF AIR DURING HUMIDIFICATION IN MINE SHAFTS. O. O. Kremnyov. Translated from Dopovidi Akad. Nauk Ukr. R.S.R., No. 1, 45-8(1958). 6p.

The analytical equation which describes the process of the polytropic compression of air during its humidification under the conditions existing in mine shafts is derived. The process of humidification is considered as an extraction heat disregarding the changes in properties of the air occurring as a result of a very slight increase in the weight of the water vapor it contains. (J.S.R.)

9870 AEC-tr-3240

FLOW THROUGH THE TWO-STAGE HYDRAULIC CYCLONE. Naoya Yoshioka, Yutaka Hotta, Tetsuo Takahashi, and Kensaku Endo. Translated from Kagaku Kikai 21, 8-16(1957). 21p.

The problem of flow movement in a two-stage hydraulic cyclone is discussed, and the experimental results are presented. The discussion is aimed mainly at the relationship between the back pressure vs. flow rate of a first-stage cyclone and the flow ratio. The conclusion arrived at can be applied to the special type two-stage cyclone in which the second-stage cyclone is attached only onto the overflow side, or to the immersion type one-stage cyclone in which the overflow and underflow pipings are immersed under water, and the flow ratio is regulated only by the difference in the surface heights of two liquids. These relationships are applicable only to a system with a dilute suspension. Unless the conditions of the overflow solution are such as to cause a blockage, a feed concentration of up to 10 wt. % can be used without any difficulties. (auth)

9871 AEC-tr-3256

HOW TO DEDUCE THE TRUE DIFFUSIVITY FROM THE DIFFUSION MEASUREMENTS OF A SUBSTANCE. TRANSPOSITION TO THERMAL KINETICS. P. Vernotte. Translated by K. S. Bevis from Compt. rend. 240, 2522-4(1955). 2p.

9872

THE COEFFICIENT OF THERMAL EXPANSION OF ZIRCONIUM NITRIDE. T. W. Baker (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Acta Cryst. 11, Pt. 4, 300(1958) Apr. 10.

9873

MAGNETORESISTANCE AND FIELD DEPENDENCE OF THE HALL EFFECT IN INDIUM ANTIMONIDE. Gaston Fischer and D. K. C. MacDonald (National Research Council, Ottawa, Can.). Can. J. Phys. 36, 527-38(1958) May.

Magnetoresistance and Hall-effect measurements in InSb are described. This semiconductor has charge carriers with sufficiently long mean free paths, l, that it is possible, even at room temperature and with available magnetic fields, to obtain l/r values considerably greater than unity, r being the orbital radius of a charge carrier moving in the applied magnetic field. The classical two-band theory has been found to account rather well for the results up to the highest magnetic fields employed. A review of the underlying assumptions of this theory is presented, and simple formulas are derived which allow the concentrations and mobilities of both types of carriers to be calculated from the magnetic field dependence of the resistivity, ρ_H, and of the Hall-constant, A_H. The parameter $\Lambda \equiv [(A_H - A_0)/A_0]/[(\rho_H - \rho_0]$ provides a useful means to check the consistency of the theory and can give some indication of the variation of the mobilities with the magnetic field. (auth)

9874

THE USE OF ELECTRON MICROSCOPE SHADOW METHOD FOR STUDYING THE POTENTIAL DISTRIBUTION OF p–n TRANSITIONS. V. N. Vertsner and L. N. Malakhov. Doklady Akad. Nauk S.S.S.R. 118, 266-8(1958) Jan. 11. (In Russian)

The electron microscope shadow method was applied in the investigation of the p-n transitions in germanium monocrystals polished into prismatic shape. The method permits a detailed study of the physical processes before and during the p-n transitions. (R.V.J.)

9875

THE VAPOR PRESSURES OF ZIRCONIUM TETRACHLORIDE AND HAFNIUM TETRACHLORIDE. A. A. Palko, A. D. Ryon, and D. W. Kuhn (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 62, 319-22(1958) Mar.

Vapor pressure determinations were made over the solid range up to the melting points, and in the case of zirconium tetrachloride, in the liquid region. Melting points for the two chlorides were determined, and the heat of sublimation, heat of vaporization, and heat of fusion were calculated from the vapor pressure curves for both chlorides. (J.R.D.)

9876

THE VAPOR PRESSURE OF VANADIUM OXYTRIFLUORIDE. LaVerne E. Trevorrow (Argonne National Lab., Lemont, Ill.). J. Phys. Chem. 62, 362(1958) Mar.

The vapor pressure of solid vanadium oxytrifluoride was measured at various temperatures from 72 to 123°C. (J.R.D.)

9877

ETHERATES OF LITHIUM BOROHYDRIDE. III. THE SYSTEM LITHIUM BOROHYDRIDE-DIISOPROPYL ETHER. John J. Burns, S. J., and George W. Schaeffer (St. Louis Univ.). J. Phys. Chem. 62, 380-1(1958) Mar.

Pressure-composition isotherms at 0, 10, 15, and 20°C for the system lithium borohydride–diisopropyl ether were determined, showing that a single solid etherate exists in this range. (auth)

9878

VAPOR PRESSURES AND MOLECULAR COMPOSITION OF VAPORS OF THE SODIUM FLUORIDE–BERYLLIUM FLUORIDE SYSTEM. Karl A. Sense and Richard W. Stone (Battelle Memorial Inst., Columbus, Ohio). J. Phys. Chem. 62, 453-7(1958) Apr.

A new study made on the vapor pressure of BeF_2 over the temperature interval 802 to 1025° showed good agreement with previous data taken over the 802 to 968° range. Excessive scatter of the vapor pressure data in the lower temperature region prevented a melting point determination of BeF_2 by the transpiration method alone. Thermal analysis showed the melting point to be about 545°. Vapor pressures of the NaF–BeF_2 system were measured over the range 509 to 1061°. On the basis of previously developed theory, it was concluded that the complex $NaBeF_3$ exists in the vapor phase in addition to NaF and BeF_2. Resolution of the vapor phase on this basis indicated that another complex might exist in the vapor phase. A plot is presented showing the

change of total pressure with composition for various temperatures. (auth)

9879

THE VAPOR PRESSURES OF $BiCl_3$ OVER LIQUID $Bi-BiCl_3$ SOLUTIONS. Daniel Cubicciotti, F. J. Keneshea, R., and C. M. Kelley (Stanford Research Inst., Menlo Park, Calif.). J. Phys. Chem. 62, 463-7 (1958) Apr.

A study of the pressure of $BiCl_3$ vapor in equilibrium with $Bi-BiCl_3$ liquid mixtures was made by the transpiration method. The study covered the range of temperature of 230 to 410° and of composition from pure $BiCl_3$ to about 0.4 in Bi mole fraction. The vapor was found to be essentially $BiCl_3$ over the entire range studied. Activities of $BiCl_3$ calculated from the vapor pressures reflected positive deviations from Raoult's law for the solution. The relative partial molal enthalpies and entropies of $BiCl_3$ in the $Bi-BiCl_3$ solutions were slightly positive for low concentrations of Bi and somewhat negative for higher Bi concentrations. (auth)

9880

ANNEALING IN SLIP BANDS IN COPPER FATIGUED AT 90°K. D. Hull (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. 3, 513-18(1958) May.

The number of slip bands formed during the fatigue of O.F.H.C. copper at 90°K and 293°K have been compared. For equivalent stresses to cause failure in 2×10^6 cycles, more slip bands are formed at 90°K than at 293°K. The number of slip bands formed increases with the length of the test. When specimens are fatigued at 90°K, and heated to room temperature at intermediate stages, the rate of increase of slip bands is much smaller than for specimens kept entirely at 90°K. The intermediate heating effectively makes the slip bands softer than the surrounding regions so that on further fatiguing slip is localized near or within the slip band. The critical temperature for the intermediate heating, above which the annealing occurs, is approximately 180°K. The results are attributed to point defect hardening during the annealing treatment. (auth)

9881

DETERMINATION OF THE RANGE-ENERGY RELATION FOR NITROGEN AND OXYGEN IONS IN PHOTOGRAPHIC EMULSIONS. D. M. Parfanovich, A. M. Semchinova, and G. N. Flerov (Academy of Sciences, USSR). Soviet Phys. JETP 6, 266-7(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3739.

9882

VISCOSITY OF LIQUID He^3 BETWEEN 0.35 AND 3.2°K AND OF He^4 ABOVE THE λ-POINT. K. N. Zinov'eva (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 609-15(1958) Mar. (In Russian)

The viscosity of liquid helium-3 was measured between 0.35 and 3.2°K by the capillary tube viscosimeter. The viscosity was found to increase slowly with lowering of the temperature from 3.2 to 1.0°K; below 1°K the increase was much greater. The temperature dependence of η in the interval 0.5 to 1.1°K can be satisfactorily described by the formula $T^{-\frac{1}{2}}$. Only below 0.5°K the dependence becomes stronger; however, it remains weaker than T^{-2}. Measurements of the viscosity of He^4 above the λ point indicate that its temperature dependence is not different from that of usual liquids, the region near the λ point being an exclusion. (tr-auth)

9883

GRAPHIC ANALYTICAL PLOTTING OF THE TRAJECTORY OF CHARGED PARTICLES IN ALTERNATING ELECTRIC AND CONSTANT MAGNETIC FIELDS. N. I. Shtepa. Zhur. Tekh. Fiz. 28, 178-87(1958) Jan. (In Russian)

A method is offered for plotting the spatial trajectories of charged relativistic and non-relativistic particles in alternating electrical fields and in constant magnetic fields. The possible errors and corrections are discussed. A short review is given of the possible applications of the method, and specific examples of plotting are presented. (tr-auth)

9884

ON THE RATIONAL USE OF THE MAGNETIC FIELDS IN HIGH FREQUENCY PROTON SOURCES. M. D. Gabovich (Inst. of Physics, Kiev). Zhur. Tekh. Fiz. 28, 872-80(1958) Apr. (In Russian)

The effects of magnetic fields on the high-frequency discharge are discussed, and practical suggestions are offered for the applications of magnetic fields in high-frequency proton sources. (tr-auth)

9885

ATOMIC ENERGY LEVELS. As Derived From the Analyses of Optical Spectra, Volume III. Circular of the National Bureau of Standards 467. Charlotte E. Moore. Washington, National Bureau of Standards, 1958. 283p. Available from U. S. Government Printing Office for $2.50.

This volume covers the elements Mo to La (Z = 42 to 56) and Hf to Ac (Z = 72 to 89) and includes the energy levels for 124 spectra. In addition to the neutral spectra, information is given on the various ionized atoms. Data are given on the electronic configuration of the ground state and many of the energy levels, the designation, the J quantum number, the intervals, the maximum energy level, and the ionization potential. Predicted and observed terms in the spectra of the isoelectronic sequences are given. No information is given on francium and only the predicted terms for astatine. (M.H.R.)

Aerosols

9886 COO-1017

Illinois. Univ., Urbana. Engineering Experiment Station.

ELECTROSTATIC EFFECTS IN THE DEPOSITION OF AEROSOLS ON CYLINDRICAL SHAPES. Technical Report No. 15. George S. Dawkins. Mar. 15, 1958. 74p. Contract AT(11-1)-276. $10.80(ph OTS); $3.90 (mf OTS).

A basic study of the mechanism of deposition of small particles on cylindrical collectors in the presence of electrostatic forces has been made. Theoretical equations predicting the efficiency of collection have been derived and solved with a digital computer. The solution of these equations is shown. The deposition of liquid aerosol particles on cylindrical collectors was measured experimentally for a range of electrostatic conditions. The experimental results agree with the theory. An experimental study was made of the effect of electrical charges on aerosol particles on the filtration efficiency of glass fiber mats. Experiments were also made on the effect of placing a potential on a mat of fine wire and on filtration by a mat of a tangled wire dipole. (auth)

9887

ON THE DETECTION OF ELEVATED RADIOACTIVITY IN AEROSOL CONDENSATES. Luise Holzapfel (Max-

Planck-Inst. für Silikatforschung, Zweigstelle Berlin-Dahlem), H. Cauer (Arbeitsmedizinisches Inst. beim Staatlichen Gewerbearzt, Bochum), and R. Reiter (Physikalisch-Bioklimatische Forschungsstelle, Farchant, Germany). Naturwissenschaften 45, 159-60 (1958). (In German)

In October 1957 in Berlin an increase was observed in the radioactivity of aerosol condensates. On the 13th an increase was measured, it reached its maximum on the 15th, and then it diminished. The condensation method and measuring method are described. (J.S.R.)

Astrophysics

Refer also to abstract 9891.

9888 SCL-T-177

CHROMOSPHERIC ERUPTIONS AND TEMPERATURES AT THE ALTITUDE OF THE 15MB, 41MB, AND 96MB PLANE. (Chromosphärische Eruptionen und Temperaturen in Höhe der 15mb-, 41mb- und 96mb- Fläche.) W. Attmannspacher. Translated by M. I. Weinreich from Meteorol. Rundschau 8, Nos. 1/2, 12-16(1955). 19p.

The reduced monthly sums of the solar eruptions for the year 1951 are compared with the monthly mean temperatures measured over Berlin, or with the monthly means of the deviations of the individual temperature values from the yearly course at 96 mb, 41 mb, and 15 mb. The temperature changes for 1951 and the first semester of 1952, determined during 24-hour periods at the altitude of the three isobar planes before and after the solar eruptions, indicate that the eruption-caused warming of the lower stratosphere acts downward, accompanied by attenuation and lag in time. This effect seems to depend on the location of the eruption on the sun's surface, as well as on its intensity and duration. (auth)

Cosmic Radiation

Refer also to abstract 10000.

9889 NP-tr-82

COSMIC RAY VARIATIONS. (Variatsii Kosmicheskikh Luchey). L. I. Dorman. Translated from a publication of the State Publishing House for Technical and Theoretical Literature, Moscow, 1957. 736p.

The experimental and theoretical methods of investigating the variations of cosmic rays (time variations of their intensity) are given, the accumulated experimental material is systematized and analyzed, and the hypotheses proposed for the origin of various types of variations are critically considered. A theory is proposed for the origin of the variations, and their correlation with various geophysical and astrophysical phenomena is examined, in particular their correlation with the properties of the solar corpuscular streams and with the electromagnetic conditions in the neighborhood of the earth, in the solar atmosphere, in interplanetary space, and in the galaxy. The book is intended for scientists occupied with cosmic-ray physics, astrophysics, geophysics, or meteorology, for students of advanced courses in these specialties, and for workers in the network of stations for continuous cosmic-ray observations. (auth)

9890

COSMIC-RAY INTENSITY VARIATIONS AT SEA LEVEL DURING MAGNETIC-STORM PERIODS. G. Ramaswamy and S. D. Chatterjee (Jadarpur Univ., Calcutta). Can. J. Phys. 36, 635-7(1958) May.

Some geophysical aspects of cosmic radiation in the light of ion chamber measurements taken at Ottawa during February–May, 1951 are discussed. A curve, % deviation from pre-storm average plotted against time, shows a general irregular pattern in variations. Cosmic-ray intensity decreases, immediately after the commencement of magnetic storms, are observable. These decreases are not within the general pattern of variations and are therefore physically real. The simultaneous decreases might be explained as being due to the magnetic storms. No theory has been conducted to successfully explain the behavior of cosmic-ray intensity during magnetic storms. (A.C.)

9891

NEW MECHANISM OF RELATIVISTIC ELECTRON PRODUCTION IN THE COSMIC SPACE. V. I. Veksler. Doklady Akad. Nauk S.S.S.R. 118, 263-5(1958) Jan. 11. (In Russian)

It is shown that the motion of quasineutral bunches of totally ionized plasma in a heterogeneous magnetic field should be followed (under certain general conditions) by production of relativistic electrons. Analysis is made of a limited bunch of quasineutral plasma composed of equal numbers of positive ions and electrons with a total transition velocity v_0 and initial velocity $v_0 < c$. The case considered corresponds to the quasineutral bunch reflection in a magnetic field at 180°. However, the qualitative analysis convincingly demonstrates the mechanism by which any motion of the quasineutral bunch in a heterogeneous magnetic field (in addition to other processes) will result in the energy transition from the heavy fraction of the bunch to the light one. (R.V.J.)

9892

HEAVY PRIMARY INTERACTIONS IN WATER LOADED EMULSIONS. V. D. Hopper, J. E. Laby, and Y. K. Lim (Univ. of Melbourne). Nuovo cimento (10) 7, 552-64 (1958) Feb. 16.

Water loaded emulsions have been used to study cut-off energy, spectrum and flux of primary particles at geomagnetic latitude and longitude 47°S, 135°W. Results agree with Störmer cut-off energy for the latitude. Most interactions in the water loaded emulsions were shown to occur in light nuclei. (auth)

9893

ON GAMMA-RAY ASTRONOMY. P. Morrison (Cornell Univ., Ithaca, N. Y.). Nuovo cimento (10) 7, 858-65 (1958) Mar. 16.

Photons in the visible range form the basis of astronomy. They move in straight lines, which preserves source information, but they arise only very indirectly from nuclear or high-energy processes. Cosmic-ray particles, on the other hand, arise directly from high-energy processes in astronomical objects of various classes, but carry no information about source direction. Radio emissions are still more complex in origin. But γ rays arise rather directly in nuclear or high-energy processes, and yet travel in straight lines. Processes which might give rise to continuous and discrete γ ray spectra in astronomical objects are described, and possible source directions and intensities are estimated. Present limits were set by observations with little energy or angular discrimination; γ ray studies made at balloon altitudes, with feasible discrimination, promise valuable information not otherwise attainable. (auth)

9894

CLOUD CHAMBER INVESTIGATION OF THE ELECTRON-PHOTON COMPONENT OF EXTENSIVE ATMOSPHERIC SHOWERS NEAR THE AXIS AT AN ALTITUDE OF 3860 m ABOVE SEA LEVEL. T. V. Danilova, O. I. Dovzhenko, S. I. Nikol'skii, and I. V. Rakobolskaya (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 541-7(1958) Mar. (In Russian)

Energy spectra of the electron-photon component of extensive air showers were investigated at an altitude of 3860 m and at various distances from the axis. Showers with $N = 1.5 \times 10^5$ were recorded. The fraction of high energy electrons and photons recorded experimentally was appreciably smaller than that computed from cascade theory, especially at small distances from the axis. At larger distances from the axis a better agreement between theory and experiment was obtained. The spatial distribution of the energy carried by the electron-photon shower component can be approximated by the law r^{-n}, where $n = 1.5 \pm 0.3$ for distances from the shower axis 1 to 9 m and for showers with $N = 2 \times 10^5$. (tr-auth)

9895

PROTON COMPONENT OF COSMIC RADIATION AT SEA LEVEL. A. G. Meshkovskii and L. I. Sokolov. Soviet Phys. JETP 6, 424-5(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 2997.

9896

CLOUD CHAMBER INVESTIGATION OF THE ELECTRON-PHOTON COMPONENT OF EXTENSIVE AIR SHOWERS AT SEA LEVEL. I. A. Ivanovskaya, G. V. Kulikov, I. V. Rakobol'skaya, and L. I. Sarycheva (P. N. Lebedev Physics Inst., Academy of Sciences, USSR and Moscow State Univ.). Soviet Phys. JETP 6, 276-80(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 2996.

9897

INVESTIGATION OF A SHOWER PRODUCED BY A SINGLY CHARGED PARTICLE OF HIGH ENERGY. E. G. Boos, A. Kh. Vinitskii, J. S. Takibaev, and I. Ya. Chasnikov. Zhur. Eksptl'. i Teoret. Fiz. 34, 622-31 (1958) Mar. (In Russian)

A 2 + 16 p shower produced by a singly charged particle of $\sim 5 \times 10^{12}$ ev energy is analyzed. The energy spectrum of the secondary particles differs from that predicted by Landau's theory but is consistent with Heisenberg's theory. The inelasticity coefficient is significantly smaller than unity. The fraction of energy expended in meson formation is of the order of 10 to 15%. The ratio of neutral π^0 mesons to charged shower particles is $R = 0.54 \pm 0.18$, which indicates that a small fraction of the charged shower particles consists of heavy mesons and nucleons. (tr-auth)

9898

ON THE FUNCTION OF SPATIAL DISTRIBUTION OF PHOTONS IN MAXIMUM CASCADE SHOWER. V. V. Guzhavin and I. P. Ivanenko (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 746-7(1958) Mar. (In Russian)

Crystallography and Crystal Structure

Refer also to abstracts 9841 and 9842.

9899

THE X-RAY DIFFRACTION SPIKES OF DIAMOND. S. Caticha-Ellis and W. Cochran (Cavendish Lab., Cambridge, Eng.). Acta Cryst. 11, Pt. 4, 245-9(1958) Apr. 10.

The theory of the anomalous x-ray reflections from certain diamonds is worked out on the assumption that they are produced by the random occurrence of an abnormal spacing in the [100] direction, as suggested by Frank. The calculation is in fair agreement with observed results. The defects are found, however not to be associated with the occurrence of silicon as an impurity in diamond, nor has any other plausible explanation of their occurrence been found. (auth)

9900

THE CRYSTAL STRUCTURE OF GOLD(III) CHLORIDE. Edward S. Clark and David H. Templeton (Univ. of California, Berkeley) and Caroline H. MacGillavry (Univ. of Amsterdam). Acta Cryst. 11, Pt. 4, 284-8 (1958) Apr. 10.

Gold(III) chloride is monoclinic, in space group $P2_1/c$, with cell dimensions $a = 6.57$, $b = 11.04$, $c = 6.44$ A, and $\beta = 113.3°$. The atomic positions were determined by Patterson and electron-density projections and were refined by Fourier and least-squares methods with three-dimensional data. The structure consists of plana molecules Au_2Cl_6 (at centers of symmetry) in which each Au has four Cl neighbors at 2.23 and 2.25 A (terminal Cl) and 2.33 and 2.34 A (bridge Cl), each ±0.02 A. Gold scattering factors in the least-squares refinement were modified for dispersion with little effect on coördinates but with appreciable effect on temperature and scale factors. (auth)

9901

NUCLEAR ORIENTATION OF Mn^{54} IN ANTIFERROMAGNETIC SINGLE CRYSTALS. J. M. Daniels and M. A. R. LeBlanc (Univ. of British Columbia, Vancouver). Can. J. Phys. 36, 638-40(1958) May.

It has been suggested by various people that nuclei might be aligned in an antiferromagnetic single crystal at low temperatures. In all the cases so far reported antiferromagnetism appears to reduce nuclear orientation rather than to enhance it. The author claims to have used the interaction in an antiferromagnetic single crystal to produce nuclear alignment and that this represents a significant extension of the class of substances in which nuclear alignment can be produced. Single crystals of $MnCl_2 \cdot 4H_2O$ containing about 3 microcuries of Mn^{54} were used in the experiment. The results of experiments are summarized graphically. (A.C.)

9902

THE ELECTRONIC STRUCTURE OF DIAMOND, SILICON AND GERMANIUM. G. G. Hall (Imperial Coll., South Kensington, London). Phil. Mag. 3, 429-39(1958) May.

The equivalent orbital method of describing the electronic structure of valence crystals, introduced in an earlier discussion of diamond, is extended in various ways. The interactions of more distant bonds are now included so that a more detailed description of the electronic structure can be given. The role of the equations as interpolation formulas is illustrated and used to deduce the effective masses of holes for diamond, silicon, and germanium. The application of the method to the conduction bands is also considered. (auth)

9903

HEAT TRANSFER DURING CRYSTALLIZATION. Ong Tjing Gie. 'S-Gravenhage, Excelsior. [1958]. 107p. (In Dutch)

The crystallization process was studied by means of unidirectional heat flow to a cooling medium through the

crystal layer formed from a liquid. The cases of the crystallization of a single component at its melting temperature and with the liquid not at its melting temperature are considered. The special cases of benzene, water, and potassium nitrate and water were studied. (J.S.R.)

Electrical Discharge

Refer also to abstracts 10001 and 10278.

9904 AERE-GP/R-2293

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A THEORY OF THE FAST-PINCHED DISCHARGE. J. D. Jukes. Jan. 1958. Changed from OFFICIAL USE ONLY Mar. 18, 1958. 15p.

A theory is presented of the initial stages of a "fast-pinching" electrical discharge in low density gas. It is shown that the gas flow following the contracting shock wave can be of a type investigated by Guderley under a particular, transient, current variation. This condition may be approximated in some experiments, such as when a constant applied voltage causes an axial current in a cylindrical discharge. (auth)

9905 AERE-T/R-1344

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CHARACTERISTICS OF CONSTRICTED GAS DISCHARGES CALCULATED BY DIFFUSION THEORY. S. J. Roberts. Feb. 1954. Decl. Apr. 23, 1958. 13p.

A procedure for calculating the theoretical characteristics of the diffusion model of the gas discharge has been applied to several examples of discharges. These models have had uniform axial electron drift, and ion temperature determined by electron bombardment. Ions and electrons reach the walls by ambipolar diffusion through the neutral gas. For a high degree of ionization, some effects due to recombination have been considered. The tabulated results give complete and consistent characteristics for several discharges, some of which are highly constricted and show the formation of a negative center. Most of the calculations made were for a three-cm radius tube, and show very high power loss for high constriction. Some calculations, however, have been carried out for discharge in a much larger tube, for which the self-magnetic effects can be produced at cost of much less power. This suggests that experiments could be carried out more easily in larger apparatus. (auth)

9906 UCRL-4744

California. Univ., Livermore. Radiation Lab.

ANALYSIS OF THE INTERACTION OF ELECTROMAGNETIC RADIATION WITH A PLASMA IN A MAGNETIC FIELD. Laurence S. Hall, Andrew L. Gardner, and Osmund T. Fundingsland. Sept. 1956. 34p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

Equations are developed to analyze the problem of the interaction of electromagnetic radiation with a semi-infinite plasma in a homogeneous static magnetic field and analytic expressions are derived describing this behavior. Appended also is a derivation of the plasma conductivity tensor (including effects of ion motion) for any plasma and static magnetic field geometry. (auth)

9907

ENERGY FROM THE ATOMIC NUCLEUS OF HYDROGEN. Atombrief 4, 70-1(1958) Mar. (In German)

The announcement by the British and Americans of their experiments and progress in thermonuclear energy is discussed. The advantages of energy production by deuterium fusion instead of by fission are presented. The experimental apparatus is briefly described. (J.S.R.)

9908

RESEARCH RESULTS IN THE AREA OF NUCLEAR FUSION. Atombrief 4, 71-3(1958) Mar. (In German)

The statement made by Lewis L. Strauss, Chairman of the Atomic Energy Commission, on Jan. 24, 1958, on the state of the American and British development and research in the field of thermonuclear reactions is presented. (J.S.R.)

9909

CONTROLLED NUCLEAR FUSION. Atombrief 4, 73-5 (1958) Mar. (In German)

The principles of control of the fusion progress are discussed with special emphasis on the pinch effect. (J.S.R.)

9910

THE AMERICAN INVESTIGATIONS IN THE AREA OF A CONTROLLED NUCLEAR FUSION PROCESS. Atombrief 4, 75-82(1958) Mar. (In German)

A survey is made of the American investigations in the field of controlled nuclear fusion processes. (J.S.R.)

9911

THE BRITISH INVESTIGATIONS ON NUCLEAR FUSION. Atombrief 4, 82-6(1958) Mar. (In German)

A survey is made of the British investigations in the field of nuclear fusion processes. (J.S.R.)

9912

THE ARGENTINE NUCLEAR FUSION EXPERIMENTS IN A NEW LIGHT. W. Ehrenberg. Atompraxis 4, 138-9(1958). (In German)

9913

MACROSCOPIC FOUNDATION OF PLASMA DYNAMICS. Taro Kihara (Univ. of Tokyo). J. Phys. Soc. Japan 13, 473-81(1958) May.

A fluid which comprises several species of charged and neutral particles is treated macroscopically. Basic equations, energy and momentum theorems, and law of similarity are discussed. The condition under which the current equation reduces to the usual form is considered, and one-dimensional transverse waves are treated as an example. Quasi-stationary phenomena are examined as a particular case, and it is pointed out that one of the usual basic equations of hydromagnetics, the Ohm's law $J = \sigma(E + \nu \times B)$, should be replaced by rot $(E + \nu \times B - \sigma^{-1}J) = 0$, ν being the velocity of the mean mass flow. An axially symmetric solution is obtained and applied to a self-pinched column, whose stability is explained in an elementary manner. (auth)

9914

EXTERNALLY PINCHED PLASMA. Tihiro Ohkawa and Taro Kihara (Univ. of Tokyo). J. Phys. Soc. Japan 13, 482-3(1958) May.

A new process of pinching a plasma column is treated theoretically. A column of plasma with no longitudinal current can be pinched by an external magnetic field parallel to the column; and the plasma thus pinched will not show any instability. The process depends on the

effective value of γ, the ratio of specific heats. For $\gamma = 2$ in particular, the temperature of a perfectly conducting plasma with no heat loss will rise in proportion to the external magnetic field. (auth)

9915

THE STRUCTURE OF STRONG COLLISION-FREE HYDROMAGNETIC WAVES. J. H. Adlam and J. E. Allen (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. 3, 448-55(1958) May.

A theoretical study has been made of the structure of strong "hydromagnetic" waves which are propagated, across a magnetic field, in a low density plasma where collisions can be neglected. Under these conditions the ions are accelerated in the direction of propagation and then brought to rest again. The thickness of the wave is determined by the characteristic distance $\sqrt{(mc^2/4\pi ne^2)}$ and the wave velocity lies between the Alfvén speed and twice the Alfvén speed. (auth)

9916

EFFECTS OF ELECTRON-ELECTRON INTERACTIONS ON CYCLOTRON RESONANCES IN GASEOUS PLASMAS. Rudolph C. Hwa (Univ. of Illinois, Urbana). Phys. Rev. 110, 307-313(1958) Apr. 15

The effect of mutual interactions between electrons on the cyclotron resonance of a gaseous discharge plasma has been studied. From the Boltzmann-Fokker-Planck equation in cylindrical coördinates, a set of simultaneous integro-differential equations is obtained and solved numerically on a digital computer for various values of magnetic field and electron density. The results indicate that the real part of the electrical conductivity of the plasma, and hence its power absorption, are reduced by the electron-electron interactions at the peak of the resonance, and that the width of the resonance is increased. The broadening of the resonance width becomes increasingly pronounced at higher charge concentrations. It is also found that, with the magnetic field equal to zero, the high-frequency conductivity of the plasma is practically unaltered by the electron-electron interactions. Thus the usual expression for the electrical conductivity of a Lorentzian gas cannot be used without discretion for high-density plasmas, where mutual electronic encounters cannot be ignored. (auth)

9917

ON THE THEORY OF A POSITIVE COLUMN IN A LONGITUDINAL MAGNETIC FIELD. M. V. Koniukov (Tula Pedagogical Inst.). Soviet Phys. JETP 6, 316-18(1958) Feb.

This article considers the contraction of the positive column in a gas discharge located in an external magnetic field directed along the discharge axis. (auth)

9918

TRANSPORT PHENOMENA IN A COMPLETELY IONIZED TWO-TEMPERATURE PLASMA. S. I. Braginskii (Academy of Sciences, USSR). Soviet Phys. JETP 6, 358-69(1958) Feb.

A system of transport equations has been obtained for a plasma consisting of electrons and one kind of positive ions placed in an electric and magnetic field. The system includes the continuity equations, equations of motion, and the equation of heat transport for electrons and ions. The electron and ion temperatures are considered to be different. The case of arbitrary ratio of the particle collision frequency to the Larmor frequency is considered. The derivation of the transport equations from the kinetic equations is similar to that of Chapman and Cowling. (auth)

9919

CYCLOTRON RESONANCE IN PLASMA. E. A. Kaner (Inst. of Radiophysics and Electronics, Academy of Sciences, Ukrainian, SSR). Soviet Phys. JETP 6, 425-7(1958) Feb.

The physical mechanism of cyclotron resonance in metals leads to the belief that a similar effect should occur in a compensated electron-ion plasma. The conditions under which resonance in plasma is possible are considered. It is concluded that apparently cyclotron resonance in plasma can be detected by selective absorption of an electromagnetic wave in the resonant region. (J.S.R.)

9920

A NEW METHOD OF PLASMA PRODUCTION FOR ION SOURCES. A. Ziegler. Z. angew. Phys. 10, 185-6 (1958) Apr. (In German)

In contrast with the present ion sources, in which the ions are produced in a gas space with low pressure, the present investigation considers a highly ionized plasma let through a small opening into a vacuum. It is then possible to start an arc discharge through the nozzle opening through which the gas is let. It is shown that the degree of ionization is unusually high, but the difficulties are in reduction of the gas consumption. (tr-auth)

9921

ON THE THEORY OF PLASMA WAVES IN DEGENERATED ELECTRON LIQUID. V. P. Silin (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 781-2(1958) Mar. (In Russian)

Electrons

Refer also to abstract 10143.

9922

THE INFLUENCE OF THE ANOMALOUS MAGNETIC MOMENT ON THE SPIN KINEMATICS OF ELECTRONS IN A UNIFORM MAGNETIC FIELD. M. Carrassi (Istituto di Fisica dell'Universita and Istituto di Fisica Nucleare, Genoa). Nuovo cimento (10) 7, 524-35(1958) Feb. 16.

The influence of a uniform magnetic field on the spin orientation of electrons, or other spin $\frac{1}{2}$ particles, in a beam is computed by assuming that the Dirac-Pauli equation correctly represents the electrons having anomalous magnetic moment. It is shown that, when the field is orthogonal to the electron beam, the anomalous magnetic moment causes the spin to turn about the field direction faster than in the normal condition. This effect depends on the energy of the electrons and becomes particularly large for energies which are high compared with the rest mass: for about 250 Mev energies a half circle path in the field would suffice to convert the longitudinal polarization state of the beam into the transverse one. The calculations are performed by making use of the exact solution of the Dirac-Pauli equation. (auth)

9923

THE ELECTRON-ELECTRON SCATTERING WITH LONGITUDINAL POLARIZED ELECTRON BEAM. K. Nagy and I. Farkas (Eötvös Univ., Budapest). Nuovo cimento (10) 7, 570-4(1958) Feb. 16.

The polarization of electrons released in the β decay of oriented nuclei was investigated. The emerging electrons have to be scattered on polarized electrons and the scattering cross section has to be measured. From the difference of this result and the result obtained

from Møller scattering, the polarization of electrons emerging from β decay can be determined. (W.D.M.)

9924

DETERMINATION OF THE STOPPING POWER OF SOME LIGHT ELEMENTS FOR 14.5 Mev ELECTRONS. G. W. Dolphin (St. Bartholomew's Hospital Medical Coll., London). Phys. in Med. Biol. 2, 234-8(1958) Jan.

An account is given of the determination of the stopping power of carbon, aluminum, water, and bone for 14.5 Mev electrons. The experimental values obtained show that the stopping power of carbon is very similar to that of bone. (auth)

9925

ENERGY DISTRIBUTION OF INELASTICALLY SCATTERED ELECTRONS. G. W. Ford and C. J. Mullin (Univ. of Notre Dame, Indiana). Phys. Rev. 110, 520-5 (1958) Apr. 15.

The spectrum of electrons at low energies and large scattering angles resulting from the scattering of high-energy electrons on atoms is considered. For thin scattering foils, the dominant contributions to this spectrum come from the following processes: (1) scattering accompanied by bremsstrahlung production, (2) scattering on bound electrons, and (3) Møller scattering followed by a single nuclear Coulomb scattering. It is found that the overwhelming majority of scattered electrons of low energy come from processes (2) and (3), thus masking the peak predicted by Parzen et al. for process (1). For high incident energy and high-Z scatterers, the process (2) is dominant. It is shown that the cross section for low-energy scattered electrons from process (2) is related to the electron-electron forward-scattering cross section. This affords a means of measuring this forward-scattering cross section. (auth)

9926

ELECTRON IN A PERIODIC ELECTRIC AND HOMOGENEOUS MAGNETIC FIELD. II. G. E. Zil'berman. Soviet Phys. JETP 6, 299-306(1958) Feb.

The energy spectrum of an electron in a magnetic field is considered in the case in which its trajectory in k-space (i.e., the intersection of the Fermi surface by a plane perpendicular to the magnetic field) is an open periodic. In this case, equidistant or quasi-equidistant discontinuities appear in the continuous spectrum. The distance between them is of the same order as that between levels in a discrete spectrum ($\sim\epsilon^2$) while the width, which is usually exponentially small or of order ϵ^4, may be of the order of ϵ^3 or ϵ^2 in individual cases. The results that are obtained are applied to the theory of the de Haas-van Alphen effect. (auth)

9927

ELECTRON MOTION ALONG SELF-INTERSECTING TRAJECTORIES. G. E. Zil'berman. Zhur. Eksptl'. i Teoret. Fiz. 34, 748-9(1958) Mar. (In Russian)

The motion of an electron along the self-intersecting trajectory shaped like the figure eight was examined. The analysis can be applied also to the cases when the trajectory, following the outline of a figure eight, has a narrow neck or when the two enclosed regions are separated. (R.V.J.)

Gases

Refer also to abstract 10257.

9928

THERMAL DIFFUSION IN DENSE GASES. J. E. Walther and H. G. Drickamer (Univ. of Illinois, Urbana). J. Phys. Chem. 62, 421-5(1958) Apr.

Thermal diffusion measurements have been made on a series of binary mixtures of gases to 500 atm. (Several systems were studied to 1000 atm.). Mixtures far from the critical temperature showed only small pressure effects. For systems where one component is near its critical temperature, a large negative value of the thermal diffusion ratio α is obtained. Neither present kinetic theories, nor the thermodynamics of irreversible processes offer a satisfactory explanation, but it is possible to get some insight into the phenomenon from each theory. (auth)

Instruments

Refer also to abstracts 10263, 10264, 10266, 10277, and 10280.

9929 APEX-365

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

CALIBRATION OF RHENIUM–MOLYBDENUM AND RHENIUM–TUNGSTEN THERMOCOUPLES TO 4000°F. J. C. Lachman. Apr. 30, 1958. 16p. Contracts AF33(038)-21102 and AT(11-1)-171. $0.50(OTS).

Calibration curves to 4000°F were established for rhenium–molybdenum and rhenium–tungsten thermocouples in vacuum, hydrogen, or inert atmospheres. The practical application of rhenium–molybdenum thermocouples is limited to measurements up to 3200°F. Rhenium–tungsten thermocouples, however, measure temperatures up to and apparently higher than 4000°F. (auth)

9930 ISC-896

Ames Lab., Ames, Iowa.

MODIFICATION OF A COUNTING DEVICE FOR THE WEISSENBERG CAMERA. David T. Peterson and C. L. Vold. [Aug. 29, 1957]. 18p. Contract [W-7405-eng-82]. $3.30(ph OTS); $2.40(mf OTS).

Presented at the Sixth Annual Conference on Industrial Applications of X-Ray Analysis, Denver, Aug. 7-9, 1957.

A North American Philips G-M Counting Attachment for use with a Weissenberg camera was modified to achieve greater accuracy and speed in measuring integrated diffraction intensities. The shape, size, and divergence of the primary beam was changed to obtain a larger and more reproducible number of counts. The receiving slit was enlarged so as to yield integrated intensities which were not affected by the diffraction peak shape. The accuracy and precision of the apparatus was determined by measuring the intensities of equivalent reflections from an ideally shaped crystal of nickel dimethylglyoxime and by measuring the diffraction intensities from a parameterless structure such as sodium chloride. Very few calculations are necessary in order to make the proper instrument settings as the necessary angles are read directly from a Weissenberg diffraction pattern. (auth)

9931

SOME HIGH-PRESSURE, HIGH-TEMPERATURE APPARATUS DESIGN CONSIDERATIONS: EQUIPMENT FOR USE AT 100,000 ATMOSPHERES AND 3000°C. H. Tracy Hall (Brigham Young Univ., Provo, Utah). Rev. Sci. Instr. 29, 267-75(1958) Apr.

Three items of equipment are described in detail: A simple-piston and cylinder device capable of generating pressures to 50,000 atmospheres simultaneously with

temperatures of 5000°C, a tetrahedral-anvil device that has been successfully tested at 100,000 atmospheres and 3000°C, and a stepped-piston device capable of developing pressures to 200,000 atmospheres at room temperature. In addition consideration is given to such problems as geometrical elements of design, higher strength materials, use of mechanical anisotropy in design, electrical leads, thermal and electrical insulation, solid pressure transmitting media, binding rings, internal generation of pressure, multistaging, and calibration. (auth)

9932

IMPROVED NMR SPECTROMETER. J. M. Mays, H. R. Moore, and R. G. Shulman (Bell Telephone Labs., Inc., Murray Hill, N. J.). Rev. Sci. Instr. 29, 300-2(1958) Apr.

An improved Pound-Knight-Watkins nuclear magnetic resonance spectrometer is described. The improved spectrometer has an arrangement which reduces frequency fluctuations by a factor of 5–10 at 30 Mc. The spectrometer is capable of stable operation, with sensitive metering, down to an rf level of 0.01 v across the sample coil, an improvement of almost an order of magnitude. The instrument also allows direct measurement of the derivative of χ', the real part of the susceptibility of the sample. (auth)

9933

FIELD DESORPTION BY ALTERNATING FIELDS. AN IMPROVED TECHNIQUE FOR FIELD EMISSION MICROSCOPY. Earl C. Cooper and Erwin W. Müller (Pennsylvania State Univ., University Park). Rev. Sci. Instr. 29, 309-12(1958) Apr.

The inclusion of field desorption in field emission microscopy yields additional information on adsorption systems and easily produces clean surfaces of metal tips without the application of heat. An alternating field technique is described using a dc-biased ac power supply for providing the desorption field during the positive portion of the cycle and allowing the observation of the field electron image during the negative portion. Ion and electron current during one cycle are calculated for a tungsten tip. Patterns from clean nickel, iron, and copper are shown. (auth)

9934

FIELD HOMOGENIZING COILS FOR NUCLEAR SPIN RESONANCE INSTRUMENTATION. Marcel J. E. Golay (Perkin-Elmer Corp., Norwalk, Conn.). Rev. Sci. Instr. 29, 313-15(1958) Apr.

The coils are assembled in two relatively thin flat stacks which are placed on each pole piece of a nuclear spin resonance magnet. One coil of each coil pair is in each of the two stacks, and each coil pair is so designed that the current circulating in it produces, in the airgap center, a correcting magnetic field describable by one of a set of spherical harmonics. The orthogonal properties of the spherical harmonics render possible substantially independent adjustments of the currents in the several coil pairs, when some spin resonance parameter such as line width is utilized to determine that individual optima are reached. Experimental coil stacks with 13 coil pairs, for the second, third, and zonal fourth harmonics, have been constructed, and preliminary results obtained by Rex Richards (Oxford) indicate that when a 4-mm spin sample is used, this method can serve to reduce field inhomogeneities to less than 1 part in 10^8 with few sets of 13 current adjustments. (auth)

Isotopes

9935

RADIOACTIVE ISOTOPES OF RHENIUM AND OSMIUM FORMED BY THE BOMBARDMENT OF RHENIUM WITY PROTONS. J. S. Foster, J. W. Hilborn, and L. Yaffe (McGill Univ., Montreal, Quebec, Can.). Can. J. Phys. 36, 555-64(1958) May.

Targets of normal rhenium, and of rhenium enriched in each stable isotope, were bombarded by protons in the energy range 10 to 80 Mev. These produced osmium and rhenium isotopes of masses 185, 183, 182, 181, and 180. After chemical separations, the gamma rays and conversion electrons were examined for half-lives, and to determine certain conversion coefficients. Independent isomers of Os^{183} with 10 and 15.4 hour half-lives were found. Gamma rays with energies 168.1, 850, and 1097 kev were assigned to the 10 hour isomer, and gamma rays with energies 114.6, 168.7, and 382.4 kev were assigned to the 15.4 hour isomer. In addition, the half-lives of Os^{185}, Os^{182}, and Re^{183} were observed to be 93.4 days, 21.9 hours, and 67.6 days, respectively. Activities with half-lives of 19 hours, 23 minutes, 18 minutes, and 2 minutes were tentatively assigned to Re^{181}, Os^{181}, Re^{180}, and Os^{180}, respectively. (auth)

Mass Spectrography

9936

NUCLEAR PHYSICS MEASUREMENT METHODS. II. THE MASS OF SPECTROGRAPH. Werner Braunbek. Atomkern-Energie 3, 197-9(1958) May. (In German)

The application of mass spectrography in the field of nuclear physics measuring methods is reviewed. The electrical and magnetic diffraction of the ion beam, variation between the mass spectrograph and the mass spectrometer, field placement and focusing, and the doublet method and precision measuring values are discussed. (J.S.R.)

9937

FISSION-FRAGMENT MASS SEPARATOR AND THE NUCLEAR CHARGE DISTRIBUTION OF FISSION FRAGMENTS OF A SINGLE MASS. Bernard L. Cohen and Clyde B. Fulmer (Oak Ridge National Lab., Tenn.). Nuclear Phys. 6, 547-60(1958) Apr. (2)

An energetic fission fragment passing through a gas changes its charge frequently by electron capture and loss collisions with gas molecules. Its average charge $\bar{e}$ is found to be very nearly proportional to velocity, so that magnetic deflection depends only on the mass; thus, passing fission fragments through a gas-filled magnetic spectrograph gives mass separation. At low pressure the resolution is limited by the statistics of the electron capture and loss process; increasing the pressure to reduce this effect is eventually limited by energy loss and the resulting multiple scattering. However, before this occurs there is a pressure range where the resolution is limited by the nuclear charge distribution of fragments of a single mass. The best resolution obtained for mass-97 fragments was 3.5% full width at half maximum of which 2.2% is due to the width of the nuclear charge distribution. Combining this with the results of a study of the dependence of $\bar{e}$ on nuclear charge, gives the width of the nuclear charge distribution for mass-97 fragments as 2.4± 0.5 units. The best obtainable resolution from the mass separator is 4.5

mass units for light fragments. Several applications of the separator are described and others are suggested. (auth)

Mathematics

9938 AECU-3686

Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. GENERAL RESEARCH. PART IV. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Feb. 1958. 31p. Contracts AT(11-1)-415, N6ori-07130 and Nonr-1834(15). $6.30(ph OTS); $3.00(mf OTS).

The design of high-powered drivers using GF 45011 transistors was studied. Floating point arithmetic, input-output, and auxiliary storage equipment under consideration are discussed. The memory access problem was studied. The diode reverse recovery test set was finished and tested. Iterative methods for solving systems of linear equations and Einstein-Maxwell field equations were studied. The new problems introduced during February are summarized. (For preceding period see AECU-3647.) (M.H.R.)

9939 AECU-3691

Los Alamos Scientific Lab., N. Mex.
THE S_n METHOD AND THE SNG AND SNK CODES. Bengt G. Carlson. Jan. 26, 1958. 63p. Contract [W-7405-eng-36]. $10.80(ph OTS); $3.90(mf OTS).

The angular segmentation (S_n) method is applied to one-dimensional problems of the stationary type, the end product being a program (the SNG code) for the IBM-704. The differential equations which define the problem and the S_n method are briefly discussed. (T.R.H.)

9940 AERE-T/L-39

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
NOTES ON THE SOLUTION OF SIMULTANEOUS LINEAR EQUATIONS. P. D. Preston. Nov. 1952. Decl. Jan. 21, 1958. 14p.

Five methods for solving simultaneous linear equations are illustrated by the solution of a set of four equations. The methods are as follows: the Gauss elimination method, Fox's method, symmetrical equations, inversion, and relaxation method. The accuracy of the solutions is discussed. (W.D.M.)

9941 KAPL-M-JA-1

Knolls Atomic Power Lab., Schenectady, N. Y.
TOSPY, A 2-DIMENSIONAL MULTI-GROUP PROGRAM FOR THE UNIVAC. OPERATING INSTRUCTIONS. Julius A. Archibald, Jr. July 19, 1956. 21p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

9942 NP-6683

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
A SIMPLIFIED METHOD OF SOLUTION FOR A RANDOM WALK PROBLEM OF A FEW UNEQUAL STEPS. Report No. 12/I-B. D. O'Connor. Feb. 1958. 11p.

A simplified method is presented of calculating the probability that the amplitude of the resultant vector formed by the vector addition of a finite number of vectors of known amplitude and random orientation will lie in a given range. This method is simpler to use for small numbers of vectors unequal in length, than methods known from the literature. Recursion formulas are given for calculating the probability functions for assemblages of vectors of equal length. (auth)

9943 ORNL-2511

Oak Ridge National Lab., Tenn.
TRANSIENT TEMPERATURES IN INFINITE PLATES, INFINITE CYLINDERS, AND SPHERES DURING CONVECTIVE COOLING FROM INITIALLY PARABOLIC TEMPERATURE PROFILES. L. G. Epel. May 19, 1958. 41p. Contract W-7405-eng-26. $1.25(OTS).

The series representing the solutions to the Fourier equation in rectangular, cylindrical, and spherical coordinates for the case in which the initial temperature field is that due to a spatially uniform heat source is evaluated. In the development, the temperature of the cooling fluid is considered to be constant. The similarities of the three geometries are emphasized by assigning the same numbers to corresponding equations with primes or double primes to distinguish the geometry involved. (J.R.D.)

9944

EQUILIBRIUM DISTRIBUTION OF MASS IN CENTRIFUGAL FIELDS. Marshall Fixman (Harvard Univ., Cambridge, Mass.). J. Phys. Chem. 62, 374-5(1958) Mar.

Suitable variables are selected which yield simple and rigorous equations governing the distribution of mass in centrifugal fields, focusing attention on the significance of the buoyant force on a macromolecule in solution. (J.R.D.)

Measuring Instruments and Techniques

Refer also to abstracts 9569, 10142, 10259, 10260, 10265, 10270, 10271, 10272, 10274, and 10281.

9945 ANL-5829

Argonne National Lab., Lemont, Ill.
RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1957. Feb. 1958. 230p. Contract W-31-109-eng-38. $5.50(OTS).

Progress is reported in the following studies: effects of various doses of gamma radiation on the light absorbance of aerated and air-free samples of xylene; the design of a light piping system for a scintillation spectrometer; the development of a simple source of monoenergetic fast neutrons and the possibility of using a spherical moderator to produce a roughly monochromatic distribution of neutrons from a source of monochromatic neutrons of a higher energy; calculation of the body retention and elimination of Ra^{228} and Ra^{224} following a single injection of Th^{232}; the analysis of gamma-ray spectra by the method of least squares; application of a microradiographic technique in determinations of the mineral density of human bones at various ages, and density values for old bone and new growth in bones from man, dogs, mice, cows, rabbits, and rats; the bone deposition of Ca^{45} following injection in dogs; determinations of the natural Ra^{226} content of 200 water samples from Illinois municipal water supplies; attempts to estimate the fraction of the stratospheric Sr^{90} in the total Sr^{90} transported to the ground by rain by observing variations in the relative amounts of Sr^{89}, Sr^{90}, and Ba^{140} in water from a series of rainfalls; the monitoring of the atmosphere for fall-out; design of a transportable gamma-ray spectrometer; soil temperature studies; the operation of an automatic data processing system for use with the soil temperature

measurements; measurements of atmospheric radon; wind-tunnel studies on dispersal patterns of stack gases; and application of a meteorological model towing tank for studies of turbulent diffusion in the atmosphere. A list is included of articles published and accepted for publication during the period. (For preceding period see ANL-5755.) (C.H.)

9946 HW-45664

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INFORMATION FOR APPLICATION OF GAMMA ABSORPTOMETERS FOR CHEMICAL PROCESSES. G. J. Alkire. Sept. 1956. Decl. July 15, 1957. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80 (mf OTS).

Fractional absorption of gamma photons from thulium-170, americium-241, or cesium-137 by uranium or plutonium in solution is measured to determine the concentration of these elements. The design of a proposed gamma absorptometer and its various components is given. (J.R.D.)

9947 NBS-5816

National Bureau of Standards. Office of Basic Instrumentation, Washington, D. C.

IMPROVED VELOCITY ANALYZER. J. Arol Simpson. Apr. 1958. 43p. NBS Project No. 0405-20-3066. $4.80(ph OTS); $2.70(mf OTS).

Because of the increased interest in the energetics of the interaction of electrons with matter a number of electron velocity analyzers have recently been designed. None of these combine the resolution, precision flexibility, and convenience of optical spectrographs. The general objective of this work is the experimental and theoretical investigation of the design and performance of an improved electron velocity analyzer. Upon successful outcome of these investigations and experiments the mechanical design of an electron spectrometer (with auxiliary power supplies, etc.) is to be completed, and construction and test of the prototype will be undertaken. Results of the study are summarized in tables and graphs. (A.C.)

9948 NRL-5122

Naval Research Lab., Washington, D. C.

A STANDARDIZED X-RAY FIELD RANGE. H. M. Childers, A. Brodsky, and A. E. Nash. Feb. 21, 1958. 17p. Project NE-101-505-3.

A 300-kilovolt x-ray machine has been adapted for use as a source of standard fields of radiation to cover the photon energy interval from 20 to 300 kev. A field range has been constructed which incorporates a free-air ionization chamber for determining the absolute value of the dose rate of the x-ray beam in roentgens per unit time. The field range has been calibrated and appropriate dose-rate curves, as well as curves for determining the effective x-ray energy, have been constructed. Procedures for use of the entire apparatus have been worked out and are described herein. The free-air chamber has been indirectly compared with the National Bureau of Standards 250-kev free-air chamber, and the agreement was within approximately one-fourth of one percent. (auth)

9949 RCC/M-9

Gt. Brit. Radiochemical Centre, Amersham, Bucks, England.

CALIBRATION OF RADON MONITOR TYPE 1056A WITH RADON SEEDS. G. H. C. Dancer and M. Michaelis. Dec. 1950. Changed from OFFICIAL USE ONLY Apr. 18, 1958. 8p.

Commercial radon "seeds" (short lengths of fine gold capillary tubing filled with radon) are allowed to decay until their content is between 10^{-12} and 5×10^{-11} curies each. The seed is then fused in a closed vessel, and the radon thus released is passed into the ionization chamber of the monitor. Counts obtained for these radon samples are plotted against the known radon concentration, and the resulting curve provides a convenient form of calibration chart. (auth)

9950 UCRL-8110

California. Univ., Berkeley. Radiation Lab.

COUNTER EFFICIENCY FOR A CYLINDRICAL SOURCE AND CYLINDRICAL COUNTER. Kent Curtis and Alice McMullen. Jan. 8, 1958. 15p. Contract W-7405-eng-48. $0.50(OTS).

Integral expressions for the efficiency of a counter arrangement consisting of a cylindrical source and cylindrical counter are derived. An IBM 650 program to evaluate these integrals is described. (auth)

9951 Y-1182

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

RESPONSE OF RADIATION MONITORS TO PROMPT-CRITICAL BURSTS. J. W. Wachter, B. J. Youngblood, and S. F. Groothuis. Apr. 8, 1958. 17p. Contract W-7405-eng-26. $0.75(OTS).

Prompt-critical bursts from the unreflected uranium reactor, "Godiva II," have been utilized to aid in the formulation of criteria for the monitoring of uranium processing areas for critical accidents, and to evaluate the detection range and reliability of several types of radiation detectors. Monitors tested were the Victoreen Remote Area Monitoring System, having both air- and BF_3-filled ion chambers, the Rocky Flats Model GM-1 NaI scintillation monitor, and the Victoreen Model 350M geiger-tube gamma monitor. All monitors operated satisfactorily at distances of 11 feet of air to at least 1,000 feet of air + 15 inches of concrete, the extreme range being significantly increased by the use of latching meter-relays. The proven range of the BF_3 monitor was about twice that of the gamma monitors. Effects due to excessive radiation were evidenced, at distances within about 10 feet of the reactor, by only one monitor, a Model 350M. Application of these test results to the problem of placement and sensitivity of process area monitors at Y-12 is discussed. (auth)

9952

FEEDBACK VACUUM TUBE VOLT METER WITH CONDENSER CHAMBER FOR RADIATION PROTECTION MEASUREMENTS. Gerhard Brunner (Institut fur angewandte Radioaktivität, Leipzig). Atomkern-Energie 3, 137-40(1958) Apr. (In German)

The requirements for an electrometer to be used in connection with a condenser chamber for radiation measurements are discussed. A mathematical treatment is given of the properties of the feedback electrometer wiring. The completed wiring diagram is given. (J.S.R.)

9953

DIFFERENTIAL CALORIMETER FOR HEATS OF FORMATION OF SOLID ALLOYS. HEATS OF FORMATION OF ALLOYS OF THE NOBLE METALS. R. A. Oriani and W. K. Murphy (General Electric Research Lab., Schenectady, N. Y.). J. Phys. Chem. 62, 327-31 (1958) Mar.

A twin, differential, high-temperature calorimeter for measurement of the enthalpy for formation of solid alloys is described. Experimental results of measurement of the heat of formation of silver–gold, gold–copper, and silver–copper alloys are presented. (auth)

9954

A PORTABLE FAST NEUTRON MONITOR. W. G. Sparke and P. K. Tomkins. Nuclear Power 3, 187-8 (1958) Apr.

The instrument described provides a meter indication which is proportional to the biological dose over a wide range of fast neutron energies. The counter consists of a 2-in.-diam. tube of stainless steel or copper, approximately 5½ in. long, lined with polythene and divided into three cells by additional polythene disks. (M.H.R.)

9955

USE OF ALUMINUM AS A THRESHOLD NEUTRON DETECTOR. F. E. Jablonski and A. F. DiMeglio (U. S. Naval Research Lab., Washington). Nuclear Sci. and Eng. 3, 631-3(1958) May.

A method of using aluminum for the determination of the neutron flux above 2.1 Mev is described. The amount of thermal and fast activation induced in the aluminum is determined by counting the gammas from the β decay products of Al^{28} and Mg^{27}, formed by thermal and fast neutron reactions with Al^{27}. The fast flux is obtained by taking the ratio of the fast and thermal induced saturation activities. To determine the fast flux at a point in a reactor, four exposures are needed—two with bare indium and cadmium-covered indium to measure the absolute thermal flux and two with bare and cadmium-covered aluminum to measure the slow and fast gamma lines without much Compton electron background. The advantages of the method are listed. (J.S.R.)

9956

POLYVINYL CHLORIDE. NEW HIGH-LEVEL DOSIMETER. Charles Artandi and A. A. Stonehill (Ethicon, Inc., Somerville, N. J.). Nucleonics 16, No. 5, 118-20 (1958) May.

Polyvinyl chloride film has been found to be a good dosimeter for electron doses in the 0.5 to 6 megarad range. It turns amber in color, and a measurement of optical density indicates the absorbed dose within 8%. The film makes a cheap, simple, accurate, and permanent dosimeter. After proper standardization it is equally good for gamma ray dose. Rigid nonplasticized film has been used. A delay period for color development must be allowed after exposure. (W.D.M.)

9957

ON THE ROSENBLUM SPARK COUNTER IN AIR. L. Daddi and L. De Franceschi (Laboratorio di Fisica dell'Academia Navale and Laboratorio di Fisica del C.A.M.E.N., Livorno, Italy). Nuovo cimento (10) 7, 895-7(1958) Mar. 16.

In a systematic study of the Rosenblum counter in air, the rods and wires mounted on a plexiglas support have been given various diameters. The gaps between rod and wire have been varied. Counts per minute have been plotted as a function of applied voltage. (W.D.M.)

9958

THE RELATIVE PERFORMANCES OF LARGE VOLUME PLASTIC AND LIQUID SCINTILLATORS. P. M. Bird (Dept. of National Health and Welfare, Ottawa, Ont., Can.) and P. R. J. Burch (Univ. of Leeds, Eng.). Phys. in Med. Biol. 2, 217-28(1958) Jan.

The practicality of large volume plastic scintillators for swift and accurate measurements of fairly high energy gamma radioactivity in human subjects was demonstrated. The plastic scintillators gave results equal to those obtained with liquid scintillators in terms of resolution and counting rate. The plastics have the additional advantages of being non-inflammable, free from toxicity hazards, easy to handle, and obviating the need for liquid seals. (C.H.)

9959

THE VARIATION OF SCATTERED X-RAYS WITH DENSITY IN AN IRRADIATED BODY. J. E. O'Connor (Saint Luke's Hospital, Dublin). Phys. in Med. Biol. 1, 352-69 (1957) Apr.

It is shown that, provided the effective atomic number remains constant, there is a general relationship between the variation of scatter with density and the variation with geometry of the system. A simplified analysis of the scatter contribution in water-equivalent bodies is presented. This analysis leads to the definition of relative scatter absorption factors, and the values of these factors in water-equivalent materials are found by experiment for radiation with a half-value layer of 1.5 mm Cu. By the application of the general relationship between density of the body and geometry of the system, values of the relative scatter absorption factors in bodies of other than unit density are deduced. These values may be employed in the calculation of the scatter dose delivered to points which lie in an inhomogeneous body. The practical importance of the results obtained is discussed with particular reference to the use of transit dose techniques. (auth)

9960

SPECTRAL EFFECTS IN THE COMPARISON OF SCINTILLATORS AND PHOTOMULTIPLIERS. Robert K. Swank and Warren L. Buck (Argonne National Lab., Lemont, Ill.) and F. Newton Hayes and Donald G. Ott (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 29, 279-84(1958) Apr.

Photomultiplier evaluation of scintillation performance is considered in the light of its marked dependence on spectral shape effects in the emission spectrum of the scintillator, in photon absorption of cell, reflector and photomultiplier window, and in the photoelectric conversion process. Relative pulse height data indicating gross differences in spectral sensitivity are presented for a group of 132 photomultipliers (types 6292 and 6342). A fluorescent converter for measuring the quantum output of liquid scintillators is described. Six scintillator solutions with fairly evenly spaced mean emission wavelengths from 3360 to 4660 A are evaluated for relative pulse height and relative photon output. Suggestions are presented for desirable methods for measuring the performance of scintillators. (auth)

9961

ISOMER SIMULATOR AND THE DISTORTION OF A DELAY ANALYZER. Sait Akpinar (Univ. of Istanbul). Rev. Sci. Instr. 29, 285-7(1958) Apr.

The decay statistics of a radioactive parent-short-lived daughter mixture is simulated by means of a circuit which superposes two random series. Daughter half-life and pulse composition can be varied between wide limits. The output distribution of a differential delay analyzer for high input rates, containing disintegrations of short-lived isomeric states in the millisecond range is tested by using the simulator. A formula for such output distributions is given. (auth)

9962

LIQUID HYDROGEN BUBBLE CHAMBER EXPANDED BY A PISTON IN THE LIQUID. E. M. Bolze, T. W. Morris, D. C. Rahm, R. R. Rau, R. P. Shutt, A. M. Thorndike, and W. L. Whittemore (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 29, 297-9(1958) Apr.

A liquid hydrogen bubble chamber with useful vol-

ume $6\frac{1}{4} \times 2\frac{3}{4} \times 3$ inches has been built which is expanded by a piston operating in the liquid hydrogen. Temperature control is provided by regulating the pressure in the hydrogen reservoir. Satisfactory tracks have been obtained with maximum expansion ratio of 3%, expansion time of about 5 msec, and chamber temperatures from 25.3 to above 27°K. Photographs have been taken with time delay between particles passing through chamber and light flash of 0.05 to 2.0 msec. (auth)

9963

EMULSION SWELLING TECHNIQUE. Francis C. Gilbert (Univ. of California, Livermore). Rev. Sci. Instr. 29, 318-19(1958) Apr.

The processing of nuclear track emulsion usually results in a shrinkage of the emulsion to less than half its original thickness due to the removal of the silver bromide during the fixing stage. A technique has been developed to return the emulsion to its original thickness by soaking in an alcohol solution for one hour. (W.D.M.)

9964

REGROUPING OF THE LATENT IMAGE IN THE PHOTOGRAPHIC ACTION OF IONIZING PARTICLES. A. L. Kartuzhanskii (Leningrad Agricultural Inst.). Soviet Phys. (Doklady) 1, 421-3(1956) July-Aug.

A theory is developed for the regrouping of the latent image in the photographic action of ionizing particles. It is shown that the ability or inability of a crystal in the emulsion to record particles of a given type and energy is determined entirely by the regrouping of the latent image. (J.S.R.)

9965

A LUMINESCENT ISODOSIGRAPH. I. M. Rozman and K. G. Tsimmer. Vestnik Rentgenol. i Radiol. No. 2, 58-65(1957) Mar.-Apr.

A luminescent detector is described which was designed for use as a dosimeter during x radiation therapy. (C.H.)

Mesons

9966 IFA-EM-34

Academia R. P. R. Institutul de Fizică Atomică, Bucharest.

REMARKS ON A POSSIBLE CASCADE DECAY OF THE τ MESON. (Observatii Asupra Unei Dezintegrări Posibile in Cascădă a Mezonului τ.) E. M. Friedländer and M. E. Mayer. 1956. 7p.

All τ meson data with known secondary energies available have been analyzed and divided into two groups, τ_2 and τ_3, according to mode of decay. In order for a particle to be considered a τ_2 it is necessary that at least one π^+ should have its energy in the 30 to 35 Mev range, and none should have an energy above 42.5 Mev. These criteria are equivalent to the assumption that the mass of the ξ particle lies in the 584 to 600 m_e range. The upper limit of the branching ratio of the two modes of decay ($\tau_3^0 \rightarrow \pi^+ + \pi^0 + \pi^- + Q$ and $\tau_2^0 \rightarrow \xi^0 + \pi^0 + Q_1 \rightarrow \pi^- + \pi^+ + \pi^0 + Q_2$) obtained by the use of the selection criteria is approximately 3/7. The assumption of a fast decay of the ξ particle speaks in favor of assigning to this particle a strangeness S = 0. Hence the τ_2 decay should be slow. The ξ particle is a neutral hypothetical particle of very short lifetime. (W.D.M.)

9967 UCRL-3522

California. Univ., Berkeley. Radiation Lab.

K-MESON DEGENERACIES. D. C. Peaslee. Oct. 1956. 15p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Some discussion is given of the possible real and charge parity degeneracies of K mesons. An explicit model is used to illustrate the superselection rule, which forbids the K meson to be a mixture of intrinsic parity states and at the same time conserve parity in decay. The discussion is extended to charge parity; the θ_1, θ_2 scheme appears to be more than an exercise in polarization phenomena and to involve a radically new basic assumption—namely, that the θ^0 and $\overline{\theta}^0$ are degenerate states. The τ^0 is compared with the θ_2 as a long-lived K meson, and a method of experimental distinction is described. (auth)

9968

EQUATION FOR THE TRAJECTORY OF A $\pi^\pm$ MESON IN AN ELECTROMAGNETIC FIELD. Mircea Zăgănesco. Compt. rend. 246, 2459-61(1958) Apr. 28. (In French)

9969

PROCESSES INVOLVED IN THE PRODUCTION OF MESONS AND HYPERONS ON THE BASIS OF DISPERSION RELATIONS. M. K. Polivanov. Doklady Akad. Nauk S.S.S.R. 118, 679-82(1958) Feb. 1. (In Russian)

An attempt was made to investigate the amplitudes of $\gamma + N \rightarrow K + Y$ (photoproduction) and $\pi + N \rightarrow K + Y$ (π-production) processes on the basis of dispersion relations to find out the characteristic features of these processes and the part played by various interactions in these processes. (R.V.J.)

9970

SCATTERING FUNCTIONS WITH CROSSING SYMMETRY: A CORRECTION. Ning Hu (Joint Inst. of Nuclear Research, Dubna, USSR). Nuclear Phys. 6, 545-6 (1958) Apr. (2).

The conclusion reached in the last section of the previous paper with the same title (Nuclear Phys. 5, 1 (1958)) cannot be upheld. It followed from an incorrect choice of Riemann sheet, due to overlooking the role of the neutral meson. (W.D.M.)

9971

ON THE THRESHOLD BEHAVIOR OF THE NEGATIVE TO POSITIVE RATIO IN PION PHOTOPRODUCTION. M. J. Moravcsik (Brookhaven National Lab., Upton, N. Y.). Nuovo cimento (10) 7, 442-50(1958) Feb. 16.

It is shown that the extrapolation used by Beneventano et al. to obtain the negative to positive ratio at threshold is very sensitive to small alterations which can be made due to the approximate nature of the procedure. Such small alterations bring about very substantial changes in the energy dependence of the ratio near threshold and hence the extrapolation is quite ambiguous in the absence of extensive experimental data on the ratio in this energy region. Since such extensive set of data does not exist at the present time, it is concluded that there is no good reason to believe that the ratio at threshold is in disagreement with the theoretical predictions. (auth)

9972

AN EXPERIMENTAL TEST OF THE FERMI-TELLER «Z-LAW». J. C. Sens, R. A. Swanson, V. L. Telegdi, and D. D. Yovanovitch (Univ. of Chicago). Nuovo cimento (10) 7, 536-44(1958) Feb. 16.

Fermi and Teller predicted, in their paper on the slowing-down process of negative mesons, the relative probabilities with which the latter should be captured by the different atoms of a chemical compound. They concluded that these atomic capture probabilities should be proportional to the nuclear charges, Z_i, of the atoms

considered. Experiments were carried out to check this prediction, based on the fact that negative muons reach rapidly the K-orbits around the nuclei of the atoms of the material in which they are slowed down, and disappear from these orbits at rates which are characteristic for the nuclei in question. Thus the time distribution of decay electrons emerging from a chemical compound in which muons are brought to rest presents in general as many exponential components as there are constituents; their intercepts at time zero are directly proportional to $n_i p_i$, where n_i = fraction of component of atomic number Z_i, p_i = capture probability into the mesic K-shell of atom of same constituent. Neglecting the possibility of transfer of muons between neighboring atoms, these p_i are equivalent to the capture probabilities predicted by Fermi and Teller. The present experiments show that at least in insulators the predictions of Fermi and Teller do not hold. No weighting of n_i with Z_i seems to arise, the lighter element being even preferred in some cases. (auth)

9973

AN ANALYSIS OF THE STRONG INTERACTION DATA. P. T. Matthews and A. Salam (Imperial Coll. of Science and Tech., London). Nuovo cimento (10) 7, 789-93 (1958) Mar. 16.

An analysis is made of the data on strong interactions based on considerations of phase space and an estimate of matrix elements based on perturbation theory. A consistent picture is obtained for a scalar K meson with all coupling constants of the order of unity. (auth)

9974

INVARIANTS IN MUON DECAY. R. Gatto and G. Luders (Univ. of California, Berkeley). Nuovo cimento (10) 7, 806-20(1958) Mar. 16.

The assumption of vanishing neutrino mass leads to a group of transformations of the neutrino field which leave commutation relations and free-field Hamiltonian invariant but change the interaction into an equivalent one giving the same physical results. This concept, which is attributable to Pursey and Pauli, is here applied to μ-e decay under the assumption of local non-derivative coupling with no restrictions as to conservation of parity or lepton charge. The physically relevant invariant combinations of coupling constants are derived, and relations between them are discussed. Use is made of a recent paper by Kinoshita and Sirlin to express all experimental information on μ-e decay in terms of these invariants. (auth)

9975

TOTAL CROSS SECTIONS FOR 190-Mev POSITIVELY CHARGED K MESONS IN COMPLEX NUCLEI. Leroy T. Kerth, Thaddeus F. Kycia, and Ludwig van Rossum (Univ. of California, Berkeley). Phys. Rev. 109, 1784-91(1958) Mar. 1.

The total attenuation cross section and the differential-scattering cross section in one angular interval were measured for K^+ mesons of 190-Mev kinetic energy. The targets were carbon, aluminum, copper, silver, and lead. The cross sections were analyzed in terms of the optical model to determine the parameters of the complex square-well potential. The average real potential was found to be 24.4 ± 2.3 Mev. The mean free path in nuclear matter was determined to be consistent with an average K^+-nucleon scattering cross section of about 10 millibarns. Some evidence was found for an increase of the mean free path in nuclear matter with Z. (auth)

9976

METHOD FOR DETERMINING THE $K_1^0 - K_2^0$ MASS DIFFERENCE. Myron L. Good (Univ. of California, Berkeley). Phys. Rev. 110, 550-1(1958) Apr. 15.

The equations of motion for the amplitudes of short-lived (K_1^0) and long-lived (K_2^0) neutral K mesons in an absorber are simplified for the case of dominance of the decay term. For the case of a thick absorber, a simple relation between the intensities of scattered and unscattered regenerated K_1^0, at zero degrees, results; the relation is sensitive to the $K_1^0 - K_2^0$ mass difference. (auth)

9977

K-MESON DISPERSION RELATIONS. I. THEORY. P. T. Matthews and Abdus Salam (Imperial Coll of Science and Tech., London). Phys. Rev. 110, 565-8 (1958) Apr. 15.

Dispersion relations for K-meson scattering are considered, particularly for the theoretical difficulties of contributions from a continuum in the unphysical region. Some general results relating to threshold values of matrix elements for creation processes in K^- + N collisions are proved. (auth)

9978

K-MESON DISPERSION RELATIONS. II. APPLICATIONS. P. T. Matthews and Abdus Salam (Imperial Coll., London). Phys. Rev. 110, 569-72(1958) Apr. 15.

The present experimental data on K^+ and K^- scattering on protons are used in the dispersion relations of the previous paper. The Λ and Σ parities are assumed to be both positive and the K^+-p potential is taken to be repulsive. The dispersion relations then indicate that an attractive K^--p potential implies pseudoscalar K mesons, and a repulsive K^--p potential implies scalar K mesons. In both cases the coupling constants are of the order of unity. If data on K-n scattering were available it would not be necessary to assume the relative parity for Λ and Σ hyperons, but this could also be determined from the dispersion relations. (auth)

9979

PARITY OF THE K MESON FROM A DISPERSION RELATION. C. Goebel (Univ. of Rochester, N. Y.). Phys. Rev. 110, 572-3(1958) Apr. 15.

It is remarked that the forward dispersion relations for K^+-nucleon scattering offer a determination of the "strong interaction parity" of the K meson. At present, the sign of the parity, determined in this way, depends on one uncertain experimental datum: the sign of the K^--p scattering length. (auth)

9980

SYMMETRIES OF THE STRONG INTERACTIONS. A. Pais (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 110, 574-8(1958) Apr. 15.

An attempt is made to study the symmetry properties of the strong baryon-meson couplings without using arguments concerning the origin of the baryon mass differences. It is shown that too high a symmetry is incompatible with associated production experiments. The argument is independent of perturbation theory. It is assumed that the Σ and Λ have the same spin, that the (Σ,Λ) parity is even, and that the usual isotopic spin assignments are correct. The general conclusions may have to be revised if it would turn out that the commonly assumed baryon spectrum is incomplete. (auth)

9981

EVIDENCE AGAINST THE REACTION $K^+ \rightarrow \mu^+ + \mu^0$. Victor P. Henri (Northeastern Univ., Boston) and Anatole M. Shapiro (Brown Univ., Providence and Harvard Univ., Cambridge). Phys. Rev. 110, 591-3(1958) Apr. 15.

The reaction can easily be distinguished from the normal $K_{\mu 2}$ decay mode by the difference of about 11

Mev in the kinetic energies of the charged muons emitted in the two reactions, or the difference of about 2 cm track length in nuclear emulsions. The present evidence is definitely in favor of the normal $K_{\mu 2}$ mode, and there is no evidence as yet for the process $K^+ \rightarrow \mu^+ + \mu^0$, unless one is willing to postulate that the mass of the μ^0 is very much less than that of the μ^+. (W.D.M.)

9982

FUNDAMENTAL INTERACTIONS AND HYPERFRAGMENTS. H. Weitzner (Harvard Univ., Cambridge). Phys. Rev. 110, 593-4(1958) Apr. 15.

With the presently existing data on hyperfragments it is possible to make preliminary tests of specific elementary particle schemes. The scheme described in detail by Schwinger, postulating in part a universal pion-baryon coupling and fundamental equivalence of baryons in the absence of K-meson interactions, is considered. (W.D.M.)

9983

A RESONANCE MODEL FOR PION PRODUCTION IN NUCLEON-NUCLEON COLLISIONS AT FAIRLY LOW ENERGIES. S. Mandelstam (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London) A244, 491-523(1958) Apr. 22

Cross-sections for pion production in nucleon-nucleon collisions are calculated on the assumption that the production takes place into a few angular momentum states only, and that the matrix element for each particular transition is constant except for factors due to the final-state pion-nucleon and nucleon-nucleon interactions. The outgoing pion is assumed to be in a resonant ($^3/_2$, $^3/_2$) state with one of the nucleons. The angular momentum states introduced are compared with those of Rosenfeld (1954) and Gell-Mann & Watson (1954). It is found that a three-parameter theory can give a good account of most of the experiments on pion production, both total and differential, up to 660 Mev, except near threshold when nonresonance production is important and further parameters are necessary. Energy distribution and angular correlation experiments bring out the importance of the pion-nucleon resonance. The cross-section for neutral pion production is predicted fairly accurately in terms of that for positive pion production from threshold to 660 Mev; at 660 Mev, the calculated positive: neutral ratio is 3·9. The difference between this value and that of Peaslee (1954) is partly due to the mass difference between the positive and neutral pion and partly to the inclusion of interference effects between the outgoing nucleons. (auth)

9984

MAGNETIC ANALYSIS OF THE REACTIONS (I) $pp \rightarrow np\pi^+$, (II) $pp \rightarrow pp\pi^0$ AND (III) $pp \rightarrow d\pi^+$ AT 660 Mev. M. G. Meshcheryakov, B. S. Neganov, I. K. Vzorov, V. P. Zrelov, and A. F. Shabudin (Inst. of Nuclear Problems, Academy of Sciences, USSR). Soviet Phys. (Doklady) 1, 447-50(1956) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Volume 11, as abstract No. 1676.

9985

PRODUCTION OF NEUTRAL π-MESONS IN VARIOUS NUCLEI BY 260-660 Mev PROTONS. Yu. D. Prokoshkin and A. A. Tyapkin (Joint Inst. of Nuclear Research). Soviet Phys. JETP 6, 245-9(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3111.

9986

THE ELASTIC SCATTERING OF 307 Mev π^--MESONS FROM HYDROGEN. V. G. Zinov and S. M. Korenchenko (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 260-2(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 2426.

9987

ON THE PRODUCTION OF π MESONS BY PROTONS ON NUCLEI OF VARIOUS ELEMENTS. A. A. Ansel'm and V. M. Shekhter (Leningrad Physico-Tech. Inst., Academy of Sciences, USSR). Soviet Phys. JETP 6, 376-8(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3113.

9988

ON K_{e3} DECAY. L. B. Okun'. Soviet Phys. JETP 6, 409-10(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3114.

9989

MESON PRODUCTION IN COLLISIONS OF HIGH-ENERGY NUCLEONS. E. G. Bubelev (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 421-2(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3115.

9990

ON THE RANGE OF MANY-BODY FORCES BETWEEN A Λ^0-HYPERON AND NUCLEONS. V. I. Ogievetskii (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 427-8(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3116.

9991

MESONIUM AND ANTIMESONIUM. B. Pontecorvo (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 429-31(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 1549.

9992

ON THE POSSIBILITY OF $\pi \rightarrow e + \nu + \gamma$ DECAY. I. Iu. Kobzarev. Soviet Phys. JETP 6, 431-2(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3118.

9993

PROCESSES INVOLVING ANTIHYPERONS. D. Amati (Univ. of Naples, Italy) and B. Vitale (The Univ., Catania, Italy). Soviet Phys. JETP 6, 435-6(1958) Feb.

The analysis of antihyperon creation and interaction processes can yield information about the quantum numbers assigned to antiparticles. The consequences of the conservation of a chosen system of quantum numbers in the fast processes involving antihyperons are discussed. (J.S.R.)

9994

CONCERNING THE THEORY OF HYPERONS. R. S. Ingarden (Wroclaw Univ., Polish Academy of Sciences).

Zhur. Eksptl'. i Teoret. Fiz. 30, No. 5, 951-3(1956). (Translated from Referat. Zhur. Fiz. No. 4, 1957, abstract No. 8489.)

In an earlier work by the author (Doklady Akad. Nauk S.S.S.R. 108, 56-9(1956)) it is shown that within the framework of the basic principles of the existing theory of elementary particles it is possible to consider a relativistic x field for which the approximate potential for the case of a point source was given. A x-field leading to the potential V(r) satisfies the equation $A = 0$ of the earlier work, from which it also follows that the x field does not exist without sources and has no state with definite energy values. The particles of the x field therefore cannot be detected by experiments with counters, cloud chambers, etc. In the present work the author considers the nucleon as a system consisting of two identical spinless particles ("m-particles"), which interact with each other through the x field and a scalar meson field. In order to prevent the "m-particles" from falling into each other, it is necessary that the x-charge a satisfy the equation $a < \sqrt{c\hbar/2} \approx 3 \times 10^{-8}$ cgs. When $a \approx 10^{-8}$ cgs the mass of the "m-particles," the binding energy of the system, and the radius of action of the intra-nucleon are approximately: $m = 1400\ m_e$, $e = 450$ Mev, $x = k^2/ma^2 \approx 0.8 \times 10^{-14}$ cm. Thus, the dissociation level lies below the mass of the highest of all known excited states of the nucleon. Calculation of the excited states in this model is possible only numerically. It is expected that the number of excited bound states is on the order of three or four and that the selection rules, connected with the interaction with the meson field, make it possible to explain the relatively long lifetimes of the hyperons.

9995

STRONG AND WEAK INTERACTIONS INVOLVING HYPERONS. N. Hu. Zhur. Eksptl'. i Teoret. Fiz. 34, 646-50(1958) Mar. (In Russian)

Gell-Mann's universal strong interaction theory is extended to weak interactions. In this scheme, however, the equality of intrinsic masses of Σ, Ξ, and N is not assumed. The theory leads to the well-known selection rule $\Delta T = \pm \frac{1}{2}$. (tr-auth)

9996

ANGULAR DISTRIBUTION IN REACTIONS $K^+ \rightarrow 2\pi^+ + \pi^-$, $K^+ \rightarrow 2\pi^0 + \pi^+$. V. N. Gribov (Leningrad Inst. of Physics in Tech.). Zhur. Eksptl'. i Teoret. Fiz. 34, 749-51(1958) Mar. (In Russian)

9997

ABSORPTION OF POLARIZED μ MESONS BY NUCLEI. E. I. Dolinskii and L. D. Blokhintsev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 759-61(1958) Mar. (In Russian)

Calculations were made of the α coefficient for μ^- meson absorption by protons bound in nuclei, and for scalar, tensor, and pseudo-scalar types of μ meson interactions with nucleons. (R.V.J.)

9998

ON THE LIFE TIME OF K_2^0 MESON. I. Yu. Kobzarev and L. B. Okun. Zhur. Eksptl'. i Teoret. Fiz. 34, 763-4(1958) Mar. (In Russian)

Analysis was made of the possible K_2^0 decays: (1) $K_2^0 \rightarrow e^+ + \nu + \pi^-$; (2) $K_2^0 \rightarrow e^- + \nu\sim + \pi^+$; (3) $K_2^0 \rightarrow \mu^+ + \nu + \pi^-$; (4) $K_2^0 \rightarrow \mu^- + \nu + \pi^+$; (5) $K_2^0 \rightarrow \pi^+ + \pi^- + \pi^0$; and (6) $K_2^0 \rightarrow \pi^0 + \pi^- + \pi^0$. The decays 1,2 and 3,4 are analogous to the decays (7) $K^+ \rightarrow e^+ + \nu + \pi^0$ and (8) $K^+ \rightarrow \mu^+ + \nu + \pi^0$, and the decays 5,6 are analogous to decays (9) $K^+ \rightarrow \pi^+ + \pi^+ + \pi^-$ and (10) $K^+ \rightarrow \pi^+ + \pi^0 + \pi^0$. In decays 5,6 and 9,10 the escaping π mesons are in the S state. The life time of the K_2^0 meson was obtained as: $\tau_{K_2^0} = 3.8 \times 10^{-8}$ sec. The probability of the decay $K \rightarrow 2\pi + \gamma$ and other possible decays of the K_2^0 meson were not analyzed; therefore consideration of these decays should somewhat reduce the value obtained for $\tau_{K_2^0}$. (R.V.J.)

9999

INVESTIGATION OF THE REACTION $\pi^+ + d \rightarrow 2p$ AT π^+ MESON ENERGY RANGE OF 174 TO 307 Mev. B. S. Neganov and L. B. Parfenov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 767-9 (1958) Mar. (In Russian)

The yield of the reaction $\pi + d \rightarrow 2p$ was determined by the difference of the double coincidence rates from the D_2O and H_2O targets. Measurements of differential cross sections in units of 10^{-27} cm^2/sterad were tabulated. The total cross sections for the reaction $p + p \rightarrow d + \pi^+$ based on the principle of detailed equilibrium equal 3.05 ± 0.23, 2.50 ± 0.18, 1.93 ± 0.14, 1.33 ± 0.12, and 0.80 ± 0.08 mb, respectively, at the proton energies 633, 690, 743, 812, and 903 Mev. The results confirm the previously published conclusions on the resonance character of the reaction. The maximum of the excitation was found at 135 Mev. (R.V.J.)

10000

PROGRESS IN ELEMENTARY PARTICLE AND COSMIC RAY PHYSICS. VOLUME IV. J. G. Wilson and S. A. Wouthuysen, eds. Amsterdam, North-Holland Publishing Company, 1958. 481p.

Chapters are included on: some theoretical aspects of the strong interactions of the new particles; the properties and production of K mesons; the interactions of μ mesons with matter; the primary cosmic radiation and its time variations; and the origin of cosmic radiation. (M.H.R.)

Microwaves

Refer also to abstracts 10261 and 10262.

10001

BASIC MICROWAVE PROPERTIES OF HOT MAGNETO-PLASMAS. J. E. Drummond (Stanford Research Inst., Menlo Park, Calif.). Phys. Rev. 110, 293-306(1958) Apr. 15.

The usual conductivity tensor of a uniform plasma in a uniform, static magnetic field (along the z axis) is generalized to include four effects of random motion of plasma electrons. These effects are due to the shape of the radio-frequency electric field strength expressed by $\nabla \times \nabla \times E \neq 0$, the partial spanning of a wavelength by an electron cyclotron orbit, and the possible variation of the radio-frequency electric field lines along the z axis of electron drift. The effects resulting cause diffusion damping, the existence of nonzero (x,z), (y,z), (z,x), and (z,y) elements in the conductivity tensor, large changes of the effective plasma density, and phase changes in the conduction current density. These results are applied to evaluation of the index of refraction of microwave signals propagating normal to the magnetic field. The existence of unusual transmission bands is predicted for very dense, hot plasmas. (auth)

Molecular Properties

10002 SCL-T-181

TRIBOLUMINESCENCE OF RUBBER. (Tribolumines-

cence Du Caoutchouc.) Zephryin Carriere. Translated by M. I. Weinreich from Cahiers phys. No. 46, 1-18(1953). 28p.

A fresh roller made of white chatterton which is unrolled in darkness, gives rise, very close to the roller, to a luminosity which has all the characteristics of triboluminescence. This study examines the set up and the conditions of the experimentation which produce the maximum luminescence, the optimum unrolling speed, the influence of the solvent, of the charge, and of the aging. A technique of progressive formation of rubberized ribbons, which confirms the hypothesis of the filiform structure of the rubber molecule, as well as of the rectilinear form of the molecular threads, when the luminosity is at its maximum during the unrolling. The spectral analysis shows that, although the unrolling engenders an electric field of several thousand volts at the point of maximum luminous intensity, the luminescence obtained has nothing in common with an electric discharge. The analysis shows also that the obtained spectra are different depending on whether the rubber is pure or charged with zinc oxide. (auth)

Neutrons

10003 LAMS-2215

Los Alamos Scientific Lab., N. Mex.

PULSED NEUTRON TECHNIQUES. G. R. Keepin. Mar. 1958. 28p. Contract W-7405-eng-36. $0.75 (OTS).

A brief survey of pulsed-neutron capabilities for reactor research and development are presented. Using pulsed-neutron techniques one can measure neutron spectra, flux densities, the basic diffusion constants, capture and scattering cross sections, neutron lifetimes, neutron age, and reactivity. As a case in point, practial application of these techniques to the Los Alamos Scientific Laboratory nuclear-propulsion reactor development program is outlined. The various types of measurements are discussed and compared with reference to pulsed-source requirements and electronics instrumentation limitations. This study has indicated three main types of source which should be considered for a general pulsed neutron program. These are: (1) electron linear accelerators, (2) positive ion accelerators (Cockcroft-Walton type), and (3) pulsed neutron generators. From each of these types, specific units may be selected which meet the requirements of mobility and versatility in a remote-control critical assemblies laboratory. A brief evaluation of each type of source is given, including pertinent performance specifications and representative cost figures. (auth)

10004 NP-6674

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

POLARIZATION OF NUCLEONS FROM THE D (γ,p)n REACTION AT MEDIUM ENERGIES. Report No. 1/VII-11. W. Czyz and J. Sawicki. Oct. 1957. 19p.

The polarization of nucleons from the D (γ,p) n reaction is investigated under the assumption of tensor coupling in the n-p interaction potential. Dipole electric, quadrupole electric, dipole magnetic, quadrupole magnetic transitions are taken into consideration. The polarization is estimated for $\hbar\omega = 65$ Mev with the help of recent nucleon-nucleon scattering phase shifts. These estimations indicate the dominant role of the dipole electric and the dipole magnetic transitions from $^3S_1 + {}^3D_1$ ground state to the $^3P_0$, $^3P_1$, $^3P_2$, $^3F_2$, and $^1S_0$ final states. The advantages of the measurement of the polarization are indicated. (auth)

10005 WAPD-TM-54(Add.)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

POLYPHEMUS. A MONTE CARLO STUDY OF NEUTRON PENETRATIONS THROUGH FINITE WATER SLABS. ADDENDUM. Heidi G. Kuehn. Feb. 1958. 14p. Contract AT-11-1-GEN-14. $0.50(OTS).

The "Polyphemus" code (WAPD-TM-54) was modified to calculate the age to indium resonance in water from an arbitrary initial energy. The results from the running of this code are discussed in WAPD-T-576. Significant changes to the history-generating code of Polyphemus 1 are briefly summarized in this addendum. (W.D.M.)

10006

ON THE GENERAL THEORY OF SLOWING DOWN OF NEUTRONS. M. V. Maslennikov (Steklov Inst. of Math., Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 118, 259-62(1958) Jan. 11. (In Russian)

10007

THE DIFFUSION COEFFICIENT OF THERMAL NEUTRONS. I. Kuscer (Univ. of Ljubljana, Yugoslavia) and M. Ribaric (J. Stefan Inst., Ljubljana, Yugoslavia). Nuovo cimento (10) 7, 451-60(1958) Feb. 16.

Diffusion of slow neutrons in an extended uniform medium is treated by a method which accounts for the thermal motion of the medium. If neutron capture is absent, a single integral equation has to be solved in order to determine the velocity distribution and the diffusion coefficient. A system of such equations is obtained for a capturing medium. For the case of a non-capturing monoatomic gaseous medium several approximations are discussed, which express the diffusion coefficient as a function of the atomic weight. (auth)

10008

ON THE OPTICAL MODEL FOR NUCLEAR REACTIONS. L. Verlet (Univ. of Paris). Nuovo cimento (10) 7, 821-8 (1958) Mar. 16.

The complex potential for neutrons in an infinite nuclear medium is computed in a perturbation calculation up to the second order, using for the nucleon-nucleon interaction, a regular potential which fits the low-energy two-body data. It is shown that it is possible to fit simultaneously the real and the imaginary part of the optical potential and the binding energy of the nuclear matter at normal density. Some arguments for the convergence of the theory are given. (auth)

10009

MAGNETIC FORM FACTOR OF THE NEUTRON. M. R. Yearian and Robert Hofstadter (Stanford Univ., Calif.). Phys. Rev. 110, 552-64(1958) Apr. 15.

Electron scattering from the bound neutron and proton in the deuteron has been studied at various scattering angles between 75° and 135° for 500-Mev and 600-Mev electrons. A comparison of these scattering cross sections with those of the free proton permits a determination of the density distribution of the magnetic cloud around the neutron. By using theories developed by Jankus and Blankenbecler, the root-mean-square radius of the neutron is shown to lie between the limits 0.80×10^{-13} cm and 0.90×10^{-13} cm. The choice between these radii depends on whether the deuteron total cross sections or differential (peak) cross sections are compared with the protonic scattering cross section. Since presently available theory has not yet developed sufficiently to decide definitely between these possibilities, the

root-mean-square size may be taken to be $(0.85 \pm 0.10) \times 10^{-13}$ cm with small error. The neutron's magnetic cloud clearly does not have the small size obtained by measurement of its charge cloud from experiments on the neutron-electron interaction, and this anomaly challenges the present concepts of nucleon size. (auth)

Nuclear Physics

10010 AECU-3685

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

PROGRESS REPORT NO. 51 [FOR] THE PERIOD SEPTEMBER 1, 1957 THROUGH NOVEMBER 30, 1957. 71p. Contracts AT(30-1)-905 and Nonr-1841(16). $10.80(ph OTS); $3.90(mf OTS).

Measurements of the distribution of hydrochloric acid between an ion-exchange resin and water indicate the activity coefficients within the resin behave essentially as in aqueous solutions of simple ions except when the mean activity is small. Values of the concentration of chloride ion and the mean activity of HCl in resin are reported. Also reported are freezing point data on Dowex-50-HCl solutions, studies of electrolyte uptake by anion-exchangers, and anion-exchange equilibria on Dowex-2. Studies of cadmium and indium nuclides formed in U^{235} fast fission were continued. A statistical mechanical theory is discussed which satisfactorily accounts for the primary and solvent isotope effects in H_2O and D_2O. Various tracer techniques were used in studies of sulfonium ion reaction with benzoyl halides, Cannizzaro Reaction mechanisms, counting efficiencies of scintillation compounds, pyridine-triphenylmethyl chloride reaction in dry benzene, phthaloyl peroxide oxygen interchange, and stereospecificity in free radical chain reactions. Special low-cost magnets were designed for use in high intensity magnetic field hyperon experiments in the Cosmotron. The design and characteristics of these magnets are given. A metal vacuum and pressure system designed for preparing gas scintillators is described. Initial rise time and pulse height studies using argon and krypton with sodium salicylate as a wave shifter are reported. The design of a differential Cherenkov counter which performed well in initial tests is presented. A nine-inch bubble chamber, filled with methyl iodide-propane mixture, was completed and tested. Photographs of π^- meson interactions detected during the tests are included. New Q-values and excited states obtained with the broad-range spectrograph are reported for V^{51}, Cr^{53}, Sc^{45}, Sc^{46}, Ca^{42}, Ag^{108}, Ag^{110}, Cu^{64}, Cu^{66}, Fe^{55}, Fe^{57}, Fe^{58} and Fe^{59}. Theoretical studies upon which the status is reported include decay of the π meson and a universal Fermi interaction, application of the method of contact transformation to the problem of nuclear collective motion, application of the Peierls-Yoccoz model to collective nuclear motion, variational calculation of the many-body Bose-Einstein system, Lorentz invariant integrals, and parity conserving interactions for K-π decay. (For preceding period see AECU-3633.) (D.E.B.)

10011 BNL-434

Brookhaven National Lab., Upton, N. Y.

NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT [FOR] FEBRUARY 15-DECEMBER 31, 1956. F. Maslan, ed. 67p. $2.00(OTS).

Studies of the statics and kinetics of Liquid Metal Fuel Reactor systems were continued. The effects of fluid compressibility, coolant channel size, and graphite penetrability were examined. Several salt-metal equilibrium experiments were carried out to determine partition coefficients for Ce in Bi-Ce-Mg and NaCl-KCl-$MgCl_2$ systems, and for Nd in Bi-Mg-Nd and NaCl-KCl-$MgCl_2$ system. Data obtained on the variation of the activity coefficient of Mg in Bi with temperature were used to calculate partial entropy-of-solution values. The first compound in the Th-Bi system is now considered to be $ThBi_2$ instead of Th_3Bi_5. Studies were continued on the distribution of Pa and U between solid thorium bismuthide and liquid Bi and Pb-Bi eutectic alloy. Studies of steel corrosion in Bi-U alloys with various additives were continued. Uranium and fission products dissolved in Bi were contacted with graphite to observe possible reactions. No uranium carbide was formed, but some fission product reactions were detected. Measurements of the sorptive properties of various graphites for liquid Bi were continued in an effort to select the graphite for the LMFR. The construction of the continuous dissolver pilot plant for the fluoride volatility process was completed and testing was started. The four constituents of the dissolver stream will be analyzed as follows: UF_6 by volumetric analysis, BrF_3 and BrF_5 by refractive index, and Br by colorimetric determination. A conceptual design was completed for a maximum neutron leakage, indium sulfate reactor for use in a food irradiation facility. Startup data for the first enriched fuel element loading of the Brookhaven Reactor were obtained. (For preceding period see BNL-418.) (D.E.B.)

10012 NRL-5131

Naval Research Lab., Washington, D. C.

THE ENERGY DISTRIBUTION OF NEUTRONS PRODUCED BY A THERMONUCLEAR REACTION. W. R. Faust and E. G. Harris. Mar. 21, 1958. 6p. Project NR-550-000.

Calculations are made to determine the energy distribution of neutrons produced in a thermonuclear reaction. Approximations as to the width and shift of the distribution function as well as the reaction rate are also made. (auth)

10013

REMARKS ON THE WEAK LEPTON PROCESSES. K. Senba (Hiroshima Univ.). Nuovo cimento (10) 7, 429-41(1958) Feb. 16.

A tentative model, a modification of Konopinski-Mahmoud's model concerning the leptons, is developed for the classification of processes where leptons take part. By means of this model, a good selection rule is obtained and the redundant neutral particle, which always appears in the model based on the charge independence hypothesis, is not introduced. The relation between this model and the N-G model is referred to, and the interaction structure with this model is briefly discussed. Although a good selection rule for lepton processes is obtained, it is concluded that for a classification of leptons, their interaction structure is always to be taken into account. (W.D.M.)

10014

ONE-PARTICLE LEVELS WITH SPIN-ORBIT INTERACTION ACCORDING TO THE SHELL MODEL FOR NUCLEI. A. Schröder (Istituto di Fisica dell'Universita and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 7, 461-90(1958) Feb. 16.

The shell model of nuclei is considered, and the average potentials for protons and neutrons are calculated on a phenomenological basis. Different assumptions about the types of spin-orbit coupling and their magnitudes are treated in the one-particle picture. Their relative influence on the one-particle levels is dis-

cussed for almost the greatest part of the periodic system (above A≈40). Calculations show that a spin-orbit interaction with only one fixed parameter λ leads to consistent results in one-particle levels: magic numbers are reproduced. The diffuse boundary potentials V(r) derived for neutrons and protons separately are in agreement with those derivable from elastic scattering experiments in the lowest energy limit. (auth)

10015

ON THE CREATION OPERATORS OF PHYSICAL PARTICLES. G. Mohan (Univ. of Nebraska, Lincoln). Nuovo cimento (10) 7, 491-500(1958) Feb. 16.

The conventional annihilation and creation operators of free particles are modified in view of the fact that all measurements require non-vanishing duration of time. The modified operators create and annihilate physical particles. Asymptotic assumption or adiabatic hypothesis are not invoked so that the renormalized S-matrix can be obtained without their help. The analysis of certain functions that occur in the definitions of the modified operators is incomplete. (auth)

10016

CONNECTION BETWEEN THE NUCLEAR SHELL MODEL AND THE UNIFIED MODEL. S. A. Moszkowski (Univ. of California, Los Angeles). Phys. Rev. 110, 403-26(1958) Apr. 15.

The general connection between the nuclear shell model and unified model is discussed. The view is toward development of a single nuclear model which can describe the low-energy features of nuclei near to, as well as far from, magic numbers. (W.D.M.)

10017

RECOIL EFFECTS IN K CAPTURE AND β DECAY. S. B. Treiman (Princeton Univ.). Phys. Rev. 110, 448-50(1958) Apr. 15.

In order to provide a wider range of possible attack on the problem of experimentally establishing the β-decay coupling types, a variety of effects involving polarization and directional asymmetries of the recoils produced in K capture and β decay is discussed. The effects in question, though they would be difficult to detect, may well be intrinsically large. They measure, essentially, the sign of the neutrino helicity. In particular, for the K-capture reaction $\mu^- + C^{12} \rightarrow B^{12} + \nu$, one has the possibility to test for parity nonconservation and to determine the neutrino helicity in μ-meson capture. (auth)

10018

POLARIZATION EFFECTS FOLLOWING BETA DECAY. H. Frauenfelder, J. D. Jackson, and H. W. Wyld, Jr. (Univ. of Illinois, Urbana). Phys. Rev. 110, 451-5 (1958) Apr. 15.

With a view to providing alternative methods of determining the dominant invariants in the beta interaction, various polarization effects following the beta decay of unoriented nuclei are discussed. In both K capture and beta emission the recoiling nucleus is polarized along its line of flight. Measurement of this polarization could determine whether the tensor or axial vector interaction is dominant. The hole in the K shell following K capture is also polarized relative to the recoil direction. Measurement of the hole polarization can distinguish between the scalar and vector as well as between the tensor and axial vector interactions. Methods for detecting the polarizations are discussed. The longitudinal polarization of the recoiling nucleus can in principle be detected directly by atomic beam techniques or indirectly by measuring the correlation between the direction of the recoiling nucleus and the direction and circular polarization of a subsequent radiation. The polarization of the hole in the K shell following K capture can perhaps be determined by a recoil-x-ray circular polarization correlation experiment. (auth)

10019

POSITRON ANNIHILATION IN THE NOBLE METALS. B. Donovan (Bedford Coll., London) and N. H. March (The University, Sheffield, Eng.). Phys. Rev. 110, 582-3(1958) Apr. 15.

A computation is reported of the positron wave function for K = 0 in copper by applying the ideas of the Wigner-Seitz method. The Fourier transform of the wave function product which determines the details of the angular correlation between the photons emitted in the annihilation experiments has been computed. There is found to be no possibility of accounting for the experimental results by any kind of "excluded volume effect." (W.D.M.)

10020

THE GELL-MANN AND PAIS ATTEMPT TO SYSTEMATIZE ELEMENTARY PARTICLES. Przemyslan Zillinski. Postepy Fiz. 7, No. 4, 331-41(1956). (Translated from Referat. Zhur. Fiz. No. 4, 1957, abstract No. 8482.)

A survey is made of the Gell-Mann and Pais attempt to systematize elementary particles. 22 references. (J.S.R.)

10021

STATIONARY STATES OF ELECTRON-POSITRON SYSTEMS AND ANNIHILATION TRANSITIONS. Chang Lee (Leningrad State Univ.). Soviet Phys. JETP 6, 281-91(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3154.

10022

MODULATION EFFECTS IN NUCLEAR MAGNETIC RESONANCE. K. V. Vladimirskii (P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Soviet Phys. JETP 6, 412-14(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, abstract No. 3155.

10023

MULTIPLE PAIR PRODUCTION IN QUANTUM ELECTRODYNAMICS. L. M. Afrikian (Physics Inst., Academy of Sciences, Armenian, SSR). Soviet Phys. JETP 6, 414-15(1958) Feb.

Approximate expressions for the effective cross sections for production of two electron-positron pairs in the collision of an electron with an atomic nucleus and in the collision of a photon with a nucleus are presented. These processes correspond to the fifth and sixth approximations of the perturbation theory in quantum electrodynamics, so that the direct computation of the values of these cross sections is difficult. (J.S.R.)

10024

RADIATION INSTABILITY IN NUCLEAR MAGNETIC RESONANCE EXPERIMENTS. K. V. Vladimirskii (P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Soviet Phys. JETP 6, 415-16(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3156.

10025

ROTATIONAL BANDS OF EVEN-EVEN AXIALLY SYMMETRIC NUCLEI. A. S. Davydov and A. A. Chaban (Moscow State Univ.). Soviet Phys. JETP 6, 428-9 (1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3157.

10026

STATISTICAL TREATMENT OF ELEMENTARY PARTICLE STRUCTURE. L. A. Kurtenkov. Soviet Phys. JETP 6, 433-4(1958) Feb.

In the quantum field theory, every charge interacts with a field of elementary particles in its vicinity. The question of whether these fields may exhibit some of the properties of ordinary particles, particularly the statistical properties is considered. From an analysis of the total energy density, the hypothesis $\Theta_n \sim \Theta_e$ is suggested. (J.S.R.)

10027

MEASUREMENT OF THE MASS OF 660 Mev PROTONS. V. P. Zrelov, A. A. Tyapkin, and P. S. Farago (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 34, 555-8(1958) Mar. (In Russian)

Measurements of the momentum ρ and velocity ν of 660-Mev protons were conducted in the external beam of the synchrocyclotron. The mass $m_1 = \rho/\nu$ was compared with the value computed in accordance with the relativistic relation $m_2 = m_0 [1-\nu^2/c^2]^{-1/2}$. Within the limits of the experimental errors both mass values are in agreement. The observed relative derivation was $\Delta m/m = 0.004\ (1 \pm 0.6)$. (tr-auth)

10028

EQUALITY BETWEEN THE INTERACTION CROSS SECTIONS OF HIGH ENERGY NUCLEONS AND ANTINUCLEONS. I. Ya. Pomeranchuk. Zhur. Eksptl'. i Teoret. Fiz. 34, 725-8(1958) Mar. (In Russian)

On the basis of the dispersion relations the equality between the interaction cross sections of high-energy nucleons and antinucleons is demonstrated. (tr-auth)

10029

ON THE INTERACTION OF HYPERONS WITH NUCLEONS. L. I. Lapidus (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 34, 777-9(1958) Mar. (In Russian)

Non-conservation of parity in hyperon decay was utilized in studies of hyperon interactions with free nucleons and in the investigation of hypernuclei. (R.V.J.)

10030

A DIRECTORY TO NUCLEAR DATA TABULATIONS. R. C. Gibbs and Katharine Way. Washington, National Academy of Sciences-National Research Council, 1958. 197p. Available from U. S. Government Printing Office for $0.70.

The comprehensive compilations of experimental and theoretical information in the fields of basic nuclear physics and chemistry published in the last few years are listed. In addition to the title, author and publication data information on the availability of the tabulation and description of the tables are given. (J.S.R.)

Nuclear Properties

10031 CF-57-2-44

Oak Ridge National Lab., Tenn.

ACTIVATION CROSS SECTION OF Na^{23} AROUND 3 KEV. W. K. Ergen. Feb. 4, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The activation cross section of sodium in the range from thermal energy through the 3-kev resonance is generally assumed to be given by the one-level Breit-Wigner formula, the Γ_γ being selected to describe correctly the known thermal absorption cross section. The contribution of this resonance to the resonance activation integral then turns out to be 0.12 barns. This somewhat indirectly inferred value is considerably larger than the value given by Dancoff et al., in an old paper, the latter value being based on experimental work. It is shown in the present memo, that Dancoff's actual measurements are quite consistent with the Breit-Wigner formula and the above mentioned Γ_γ. The discrepancy is a result of Dancoff's transition from the actual measurements to the resonance integral, this transition being based on data that is now obsolete. (auth)

10032 NP-6678

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

ON NUCLEAR MAGNETIC RESONANCE IN FLOWING LIQUID. Report No. 6/11. T. Waluga and A. Z. Hrynkiewics. Dec. 1957. 10p.

An investigation was made of nuclear magnetic resonance in a stream of flowing liquid. The dependence of the amplitude of the absorption lines on the rate of flow was investigated. It was established that the flowing liquid method allows an independent determination of the saturation factor and the longitudinal relaxation time; in this connection, the relaxation time measurement may be made for any degree of saturation. It was also shown that the limit of applicability of the method can, in comparison with the limit given by Suryan, be shifted considerably in the direction of long relaxation times. (auth)

10033 UCRL-3456

California. Univ., Berkeley. Radiation Lab.

ALPHA-DECAY STUDIES IN THE HEAVY-ELEMENT REGION (thesis). John Philip Hummel. July 3, 1956. 161p. Contract W-7405-eng-48. $25.80(ph OTS); $7.80(mf OTS).

Using primarily a 75-cm radius of curvature 60° symmetrical electromagnetic analyzer, a study of the complexity of the following alpha spectra was made: Es^{253}, Cf^{246}, Cm^{244}, Am^{243}, $Pu^{236,242}$, Pa^{231}, $Th^{227,230}$, Ac^{225}, At^{209}, and Po^{206}. An investigation of the gamma rays associated with the following isotopes was also made: Cf^{246}, $Cm^{242,244}$, Am^{243}, Pu^{236}, and Pa^{231}. Decay schemes have been suggested for most of the isotopes included in this study. Those for the even-even isotopes were found to conform well with the previously existing systematics for that group of nuclides. Many of the decay features of the odd-mass isotopes seemed to conform well with presently expanding theories. (auth)

10034

SPIN-ORBIT INTERACTION IN NUCLEI. B. P. Nigam and M. K. Sundaresan (National Research Council, Ottawa, Can.). Can. J. Phys. 36, 571-8(1958) May.

Brueckner's theory of nuclear structure has been used to estimate the spin-orbit interaction of a single nucleon interacting with the core arising from the tensor force of the two-body interaction. Using Yamaguchi's separable two-body interaction, the doublet splitting for Ca^{41} and O^{17} has been calculated (i) in the first Born approximation and (ii) with an exact solution of the reaction matrix in which the exclusion principle has been taken into account. It is found that

the values of the splittings calculated exactly are smaller than the experimental values. (auth)

10035

THE RATIO OF THE NUCLEAR g-FACTORS FOR B^{11} AND B^{10}. W. Brouwer and H. E. Petch (McMaster Univ., Hamilton, Ont., Can.). Can. J. Phys. 36, 632-4(1958) May.

The nuclear magnetic resonance (N.M.R.) and atomic hyperfine structure methods for the measurement of a nuclear g-factor depend upon the interaction of the nuclear magnetic moment with an applied external magnetic field or with an internal atomic field, respectively. In the N.M.R. method the ratio of the resonance frequencies for two isotopes gives the ratio of their nuclear g-factors directly. However for some pairs of isotopes the terms containing the effects of the internal fields differ slightly. In such cases, the ratio of the A's, the internal interaction constants, obtained by the atomic hyperfine structure method is not exactly equal to the ratio of the g's. It has recently been pointed out that, to establish the h.f.s. anomaly for boron, a more precise value is needed for the ratio of the nuclear g-values of B^{11} and B^{10}. The values for the ratio of A's calculated from a h.f.s. measurement and the g values obtained by N.M.R. method agree within the latter's rather large limits of error so that there appears to be no h.f.s. anomaly. (A.C.)

10036

ON THE FIRST LEVEL 0^+ OF THE NUCLEUS O^{16}. Jean Pradal and Marcel Vénéroni. Compt. rend. 246, 2461-4(1958) Apr. 28. (In French)

A calculation of all interactions shows that, contrary to previous reports, the first level 0^+ can not be explained by a mixture of only the configurations $(1s)^{-1}(2s)$ and $(1p)^{-1}(2p)$. (tr-auth)

10037

DETERMINATION, WITH A BETATRON, OF THE ENERGY OF THE ISOMERIC STATE OF 8.15 hr Ta^{180}. Mark Gusakow and Robert Basile. Compt. rend. 246, 2464-6(1958) Apr. 28. (In French)

By direct measurement of the photoneutrons from the $Ta^{181}(\gamma,n)Ta^{180}$ reaction and measurement of the 8.15 hr activity induced in the residual Ta^{180} nuclei, the energy of the metastable level of Ta^{180} was determined to be 65 ± 25 kev. The absolute value of the threshold was 7.7 ± 0.1 Mev and was in good agreement with previous results. (J.S.R.)

10038

DECAY OF ^{152}Eu AND THE UNIFIED NUCLEAR MODEL. S. K. Bhattacherjee, T. D. Nainan, Shree Raman, and Baldev Sahai (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 7, 501-23 (1958) Feb. 16.

The radiations from Eu^{152} ($t_{1/2}$ = 13 years) were investigated. X−γ, γ−γ, and β−γ coincidence experiments were used to construct the decay scheme of Eu^{152}. The difference in level structure in Sm^{152} and Gd^{152} is evident from the experimental results. The highest excited state in Sm^{152} is at 1417 kev and is likely fed entirely by L-capture. The level at 1114 kev in Gd^{152} has the character I = 3 and is interpreted as due to the octupole vibrations. The ground state of Eu^{152} has been assigned the spin I = 4; the branching ratios and the transition probabilities for the β groups and electron capture transitions have been calculated. The experimental results are consistent with the predictions of the unified nuclear model. (W.D.M.)

10039

NUCLEAR ORIENTATION OF PRASEODYMIUM 142. M. A. Grace, C. E. Johnson, R. G. Scurlock, and R. T. Taylor (Clarendon Lab., Oxford). Phil. Mag. 3, 456-60 (1958) May.

To test whether polarization of Pr^{143} was likely to be obtained, experiments have been carried out on the neighboring 19-hr isotope Pr^{142} whose orientation can be detected and measured by observation of its gamma radiation. A single crystal of cerium magnesium nitrate was grown from solution containing Pr^{142}, and this was mounted in the demagnetization cryostat: it was estimated that about 0.5% of the Ce^{3+} ions had been replaced by Pr^{3+}. The crystal was then cooled by adiabatic demagnetization, and the γ-ray anisotropy was measured as a function of temperature in zero field. (W.D.M.)

10040

NUCLEAR MAGNETIC RESONANCE IN LiF. F. J. Low and C. F. Squire (Rice Inst., Houston). Phys. and Chem. Solids 5, 85-8(1958).

The line width of the nuclear magnetic resonance in a single crystal of LiF has been observed as 11 G for Li^7 and 12 G for F^{19}; these values are constant with temperature between 1.4 and 80°K. The spin-lattice relaxation time, T_1, has been measured by observing the exponential growth of the absorption signal after saturation. The value of T_1 for Li^7 is 3.6×10^4 sec at 1.4°K and is 7.8×10^2 sec at 80°K; for F^{19} the value of T_1 is 1.8×10^4 sec at 1.4°K and is 3.0×10^2 sec at 80°K. These values are for a steady field of 4 kG. (auth)

10041

QUADRUPOLE MOMENTS OF As^{75}, La^{139}, AND Hg^{201}. Kiyoshi Murakawa (Univ. of Tokyo). Phys. Rev. 110, 393-6(1958) Apr. 15.

It is shown that the level $5d^34s\ ^5F_1$ of Ta II is approximately free from perturbation, making the calculation of the quadrupole moment simple. Then it is shown that the quadrupole coupling constant in the hyperfine structure (hfs) of this level can be interpreted if one assumes a rather large antishielding effect $\Delta(5d^34s) = -0.77$. In the course of the calculation the magnetic moment $\mu(Ta^{181}) = 2.4 \pm 0.2$ mm was obtained, Upon assuming the shielding corrections $\Delta(5d6s) = -0.3$ and $\Delta(6s6p) = -0.1$ for any heavy element around Lu, the quadrupole moments $Q(La^{139}) = 0.2_1 \pm 0.04$ barn and $Q(Hg^{201}) = 0.4_2 \pm 0.04$ barn were obtained. In the case of La II $5d4f\ ^3D_1$, a negative quadrupole moment was obtained by neglecting the shielding correction. This can be interpreted by assuming a large antishielding effect in the 4f electron. In connection with this a tentative value $Q(Er^{167}) = 4$ barns was deduced. Upon assuming $\Delta(4p5s) = -0.16$ for the hfs of the spectrum of As II, the value $Q(As^{75}) = 0.27 \pm 0.04$ barn was obtained. From the hfs of a level of the configuration 4p5p of As II, the value of 0.12 ± 0.07 barn was obtained, the shielding correction being neglected; and this is interpreted to be due to a possible large antishielding effect in the 5p electron. The same tendency seems to be detectable in the published determination of $Q(K^{39})$ from the 5p state of K I. (auth)

10042

TOTAL NEUTRON CROSS SECTIONS OF Mg, Al, Fe, Cu, Zn, Mo, AND Pb FROM 4 TO 8 Mev. J. L. Weil and K. W. Jones (Columbia Univ., New York). Phys. Rev. 110, 466-7(1958) Apr. 15.

The total neutron cross sections of Mg, Al, Fe, Cu, Zn, Mo, and Pb have been measured for neutron energies between 4 and 8 Mev. The results are compared with previous measurements in the same energy region. (auth)

10043

NUCLEAR SPIN OF GALLIUM-68. J. C. Hubbs, R. Marrus, and J. L. Worchester (Univ. of California, Berkeley). Phys. Rev. 110, 534-5(1958) Apr. 15.

The atomic-beam magnetic resonance method has been used to measure the nuclear angular momentum of 68-minute gallium-68. It is found that I = 1. (auth)

10044

SPIN AND QUADRUPOLE MOMENT OF I^{125} AND THE MAGNETIC MOMENT OF I^{131}. P. C. Fletcher and E. Amble (Columbia Univ., New York). Phys. Rev. 110, 536-43(1958) Apr. 15.

The spin and quadrupole moment of I^{125} have been determined by observations on the microwave absorption spectrum of CH_3I^{125}. Five absorption lines have been observed which fit the quadrupole hyperfine pattern of the J = 2 ← 1 rotational spectrum. The measurements indicate a spin of $^5/_2$ and a quadrupole coupling constant of −2179 ± 1 Mc/sec. Using this and other known properties of the CH_3I molecule, the quadrupole moment of I^{125} is calculated to be -0.66×10^{-24} cm^2. This spin and quadrupole moment suggest a nuclear configuration for I^{125} similar to that of stable I^{127}, i.e., predominantly $d_{5/2}$. The magnetic moment of I^{131} has been measured by observation of the Zeeman splitting of the F = $^9/_2$ ← $^9/_2$(K = 1) hyperfine line of the J = 2 ← 1 rotational spectrum of CH_3I^{131}. The magnetic moment is found to be 2.56 ± 0.12 nuclear magnetons. The observations also confirm the previous results of Gordy et al. for the spin of I^{131} of $^7/_2$ and quadrupole coupling constant, eqQ = −974 ± 1 Mc/sec. The magnetic moment measurement suggests a ground-state configuration similar to that of I^{129} which is predominantly $g_{7/2}$ in nature but with large admixture of other states. The significance of these results are discussed. (auth)

10045

SPINS OF SILVER-105, SILVER-106, AND SILVER-110m. W. B. Ewbank, W. A. Nierenberg, H. A. Shugart, and H. B. Silsbee (Univ. of California, Berkeley). Phys. Rev. 110, 595-6(1958).

The spins of three radioactive silver isotopes, Ag^{105}($T_{1/2}$ = 40 days, I = $^1/_2$), Ag^{106}($T_{1/2}$ = 8.3 days, I = 6), and Ag^{110m}($T_{1/2}$ = 253 days, I = 6), have been measured by atomic-beam techniques. (W.D.M.)

10046

THE MAGNETIC DIPOLE AND ELECTRIC QUADRUPOLE MOMENTS OF DYSPROSIUM 161 AND 163. J. G. Park (Clarendon Lab., Univ. of Oxford). Proc. Roy. Soc. (London) A245, 118-27(1958) May 6.

Paramagnetic resonance has been observed at 4.2°K and a wavelength of 3.1 cm in magnetically dilute crystals of the acetate and double magnesium nitrate of dysprosium. Values for the nuclear spins and nuclear magnetic dipole moments of the odd isotopes Dy^{161} and Dy^{163} have been deduced from the spectrum in dysprosium acetate, although the spectrum does not have axial symmetry and cannot be analyzed in detail. More reliable values for these moments have been obtained from the spectrum of dysprosium double nitrate, which has axial symmetry. It has also been possible to make an approximate calculation of the electronic ground state of dysprosium ions in this salt and estimate the nuclear electric quadrupole moments. The values of the moments are: $\mu^{161} = -0.37 \pm 0.04$ n.m.; $\mu^{163} = +0.51 \pm 0.06$ n.m; and, in units of 10^{-24} cm^2, $Q^{161} = +1.1 \pm 0.4$; $Q^{163} = +1.3 \pm 0.4$. For each isotope, only the relative signs of the two moments were determined experimentally; the signs quoted above are suggested as the most probable ones. (auth)

10047

COLLECTIVE MOTION IN THE NUCLEAR SHELL MODEL. I. CLASSIFICATION SCHEMES FOR STATES OF MIXED CONFIGURATIONS. J. P. Elliott (Atomic Energy Research Establishment, Harwell, Didcot, Berks.). Proc. Roy. Soc. (London) A245, 128-45(1958) May 6.

To understand how collective motion can develop in the shell-model framework, it is necessary to study configuration interaction. With this in mind, group-theoretical methods are used to investigate the possible classification schemes for a number of nucleons in mixed configurations. One particular coupling scheme, which is associated with the degeneracy of a harmonic oscillator potential and which will be shown to have collective properties is described in detail. The wave functions in this scheme are seen to be very similar to those resulting from an actual shell-model calculation with configurational mixing. (auth)

10048

CLASSIFICATION OF NUCLEAR MAGNETIC MOMENTS. I. A. Vaisman. Soviet Phys. JETP 6, 319-22(1958) Feb.

It is proposed that the region of maximum concentration of the nuclear magnetic moment values be delimited by introducing, along with the Schmidt and Dirac lines, new lines as boundaries of these regions. Empirical data are presented as a proof of the real significance of these lines. It is noted that the quenching of the anomalous part of the nucleon magnetic moment in nuclear matter, which takes place in addition to that from deformation of the nucleus, is, apparently, more important for the formation of nuclear magnetic moments than usually considered. (auth)

10049

THE NUCLEAR QUADRUPOLE MOMENT OF U^{233}. A. G. Zimin and N. M. Iashin. Soviet Phys. (Doklady) 1, 419-20(1956) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 2227.

10050

MEASUREMENT OF THE ABSORPTION CROSS SECTION FOR FAST NEUTRONS. T. S. Belanova. Zhur. Eksptl'. i Teoret. Fiz. 34, 574-8(1958) Mar.

Absorption cross sections for 25, 220, and 830 kev photoneutrons are obtained for 20 elements. (tr-auth)

10051

NUCLEAR MAGNETIC MOMENTS OF Sr^{87} AND Mg^{25}. A. G. Kucheryaev, Yu. K. Gzhenov, Sh. M. Gogichaishvili, I. N. Leont'eva, and L. V. Vasil'ev. Zhur. Eksptl'. i Teoret. Fiz. 34, 774-5(1958) Mar. (In Russian)

The value for the Sr^{87} nuclear magnetic moment is $\mu(Sr^{87}) = 1.0939 \pm 0.0014$ nuclear magnetons and $g(Sr^{87}) = 0.2423 \pm 0.0003$. No reference was made in the article to Mg^{25}. (R.V.J.)

10052

NUCLEON–NUCLEON CROSS SECTION IN THE HIGH ENERGY RANGE. R. B. Begzhanov (Inst. of Physics, Armenian, SSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 775-6 (1958) Mar.

Calculations of cross sections for inelastic interactions of protons with nuclei of C and Pb, measured with the smoothed nuclear model, showed that the experimental cross sections for Pb σ_a = (1740 ± 90) mb and for graphite σ_a = (210 ± 15) mb coincide with the calculated cross sections $\bar{\sigma}_a$ = (32 ± 3) mb. The value $\bar{\sigma}$ corresponds to the total effective cross section for nucleon–nucleon interactions at energies up to 34 Bev. The

results are in good agreement with the experimental data for determination of nucleon–nucleon cross sections at energies up to 5.3 Bev and for nucleon–nuclei cross sections. Hence, it is shown that the basic interaction processes up to 34 Bev do not differ from the interactions in the energy range possible in present accelerators. (R.V.J.)

Nuclear Reactors

Refer also to abstracts 10267, 10269, 10275, 10276, and 10279.

10053 AECU-3220
[Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.]
EMISSION RATE OF FISSION PRODUCTS FROM A HOLE IN THE CLADDING OF A REACTOR FUEL ELEMENT. [Report] 412FF124. Carl W. Helstrom. July 26, 1956. 11p. $3.30(ph OTS); $2.40(mf OTS).

It is assumed that when a hole appears in the cladding of a reactor fuel tube the fission products in the space between the fuel and the cladding will diffuse towards the hole. There they are swept away by the flow of steam past the hole. The process of diffusion is assumed to be governed by the ordinary diffusion equation with the boundary condition that the density of the fission products is zero at the surface of the hole. The diffusion equation is solved for the case of steady-state emission for a number of geometrical arrangements: long slit in plane surface; long slit in cylindrical surface; circular hole in plane surface; circular hole in cylindrical surface; hole at end of cylindrical fuel rod; and diffusion space of variable thickness. The time-dependent solution of the diffusion equation is also found for a planar diffusion space. The effect of a temperature gradient is discussed. (A.C.)

10054 AECU-3688
Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.
PRELIMINARY SUMMARY REPORT ON THE PROPOSED UNIVERSITY OF FLORIDA TRAINING REACTOR AT GAINESVILLE, FLORIDA. J. M. Duncan. Aug. 1957. 145p. $22.80(ph OTS); $7.20(mf OTS).

This is a preliminary report on the location, conceptual design, and hazards analysis of the University of Florida 10-kw Training Reactor. The reactor design was developed as a modification of the Argonaut type. (W.D.M.)

10055 AERE-R/R-2358
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE INTERPRETATION OF APPROACH-TO-CRITICAL EXPERIMENTS WITH APPLICATION TO ORGANIC LIQUID MODERATED SYSTEMS. L. G. Sanders and A. K. McCracken. Dec. 1957. 39p.

A method was devised for obtaining k_∞ from approach-to-critical experiments when the system is far from the critical condition. In this case flux harmonics are present in appreciable proportions and the analysis is designed to extract the fundamental term from the flux distribution. Tables have been prepared with a punched-card computer for this purpose. The results were applied to experiments performed with a lattice of 1.2 in. diameter uranium rods of enrichment 1.0, 1.3, and 1.6% moderated with a commercial mixture of diphenyl and diphenyl-oxide. (auth)

10056 AMF-GR-10-56 and Suppl. 1
American Machine and Foundry Co. Nuclear Engineering Lab., Greenwich, Conn.
HAZARDS SUMMARY REPORT, FOR INDUSTRIAL REACTOR LABORATORIES, INC. June 1956. 422p. Supplement No. 1. Feb. 1958. 34p. For AMF Atomics, Inc.

These two reports were issued separately, but are cataloged as unit.

This 5-Mw pool-type research reactor is a light-water-moderated, heterogeneous, solid-fuel reactor in which water is used for cooling and shielding. The reactor core is immersed in a two-section concrete pool filled with water. One of the sections of the pool contains an experimental stall into which beam tubes and other experimental facilities converge. The other section is an open area for making bulk irradiations. The reactor can be operated in either section. Two manually operated bridges span the pool. The reactor is supported by an aluminum tower suspended from one movable bridge, and experimental equipment is supported by an aluminum tower suspended from the other movable bridge. Control of the reactor is accomplished by the insertion or removal of neutron-absorbing control rods which are suspended from control drives mounted on the reactor bridge and by the temperature coefficient of reactivity. Heat created by the nuclear reaction is dissipated by a forced-convection cooling system. Remotely located pumps, storage tanks, water-cooled heat exchanger, cooling tower, demineralizer, and filter complete the water handling system for the reactor pool. The site geography, reactor building, and plant facilities are described in detail. Operating procedures are outlined. Potential hazards are surveyed and methods suggested for their control. Changes in procedures and calculations are presented in Supplement No. 1. (C.H.)

10057 APAE-10(Vols. I and II)
Alco Products, Inc., Schenectady, N. Y.
PHASE III DESIGN ANALYSIS FOR THE ARMY PACKAGE POWER REACTOR. VOLUME I. DESIGN ANALYSIS. VOLUME II. FABRICATION AND CONSTRUCTION DRAWINGS. Aug. 15, 1956. Reissued Aug. 30, 1957. (Vol. I, 276p. and Vol. II, 72p.) Contract AT(11-1)-318. $6.50(OTS).

Analysis of design is given in chapters on: building and grounds, secondary system, primary system, reactor analysis, shielding analysis, instrumentation, water treatment, health physics, and waste disposal, including figures, sketches, and appendices. Reference is made to drawings and diagrams bound in Volume (II), and in available classified and unclassified reports. (M.H.R.)

10058 APAE-Memo-78(Rev. II)
Alco Products, Inc., Schenectady, N. Y.
HEALTH PHYSICS MANUAL FOR THE ARMY PACKAGE POWER REACTOR. B. M. Ball. Jan. 18, 1957. Rewritten Apr. 1, 1958 by B. James. 109p. Contract AT(11-1)-318. $18.30(ph OTS); $6.00(mf OTS).

The Army Package Power Reactor is a 10,000-kilowatt pressurized water reactor with stainless steel fuel elements and fissionable material, and burnout poison in the form of boron. The reactor operates at a pressure of 1400 psia and outlet temperature of 450°F at full power. Two primary coolant pumps in parallel are provided. The water flows from the reactor to the steam generator, where heat is transferred to the steam system from the generator and back through the pump to the reactor outlet. Sources of potential radiation hazard and their control are discussed. Fundamentals of

radiological safety, hazards control, and safety rules are reviewed. (C.H.)

10059 APAE-Memo-127(Vol. I)
Alco Products, Inc., Schenectady, N. Y.
APPR-1 REACTOR TRANSIENT ANALYSIS. VOLUME I. BASIC KINETIC MODEL AND EQUATIONS. J. O. Brondel. Apr. 25, 1958. 27p. Contract AT(30-3)-326. $4.80(ph OTS); $2.70(mf OTS).

A basic kinetic model of the primary system coolant loop is developed for the Army Package Power Reactor -1. Externally controlled variables are control rod insertion and steam generator power output. Equations are derived for solution by analog computer techniques, and include the following considerations: transport lag of coolant through primary system piping, core temperature and pressure reactivity coefficients, heat storage capacity of fuel plates, primary and secondary system liquid, and of steam generator tubes, five group delayed neutron contributions, and portion of core power generated outside fuel plates. The significant assumptions made in the derivation include: core considered as a lumped system, with fuel plates at a uniform mean temperature, and with a uniform coolant velocity distribution, steam generator considered as a lumped system, with a uniform shell-side temperature corresponding to saturation, and with a constant over-all heat transfer coefficient, and slug flow in piping, complete mixing in reactor vessel plenum chambers. Refinements in the model, at the expense of increasing the complexity of the mathematical treatment and the associated analog circuitry, are contemplated. (auth)

10060 BMI-1262
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING APRIL 1958. Russell W. Dayton and Clyde R. Tipton, Jr. May 1, 1958. Decl. June 3, 1958. 71p. Contract W-7405-eng-92. $10.80(ph OTS); $3.90(mf OTS).

Results are given from studies on: mechanical properties of Zircaloy-2; preparation of Al–U alloys; effects of N, Ca, Zr, and Mo on electrical properties of UO_2; effect of chloride, fluoride, and sulfate contamination on corrosion of type 304ELC stainless steel in boiling HNO_3; density of Mallinckrodt slag and MgF_2-base materials; development of gamma-phase U alloys; preparation of U–Nb alloys; oxidation of Nb and Nb alloys in dry air at 1000 and 1200°C; thermal expansion of UBe_{13} and UC; phases and compositions in C–N–U system; creep of arc-cast Ta during exposure to high-temperature Na; pressure bonding of PWR fuel plates; evaluation of UC as reactor fuel; and fabrication of UO_2 fuel pellets for NMSR loop tests. (For preceding period see BMI-1259.) (T.R.H.)

10061 BNL-440
Brookhaven National Lab., Upton, N. Y.
DESIGN CRITERIA FOR GAMMA IRRADIATION DEVICES USING FLUIDS FLOWING THROUGH REACTOR LOOPS. B. Manowitz, D. J. Metz, D. M. Richman, O. A. Kuhl, L. Galanter, and R. H. Bretton. July 1956. 109p. $2.50(OTS).

Design criteria are considered for a food irradiation facility having minimal irradiator and piping holdup and maximal reactor blanket holdup. The flow rate should be high and the parent isotope concentration should be as high as chemically possible. The start-up time and the time for the system to become saturated and reach its maximum specific activity are a function of the half-life of the isotope chosen as the irradiator. Consideration was given to the fact that sodium-24 has a high-energy gamma ray that will cause (γ,n) reactions on deuterium. A calculation of the number of neutrons generated per second was made, and the absorption of these neutrons was calculated. Design of the irradiator is discussed in detail. (C.H.)

10062 CERD-S1C-1100-RS-4
Combustion Engineering, Inc. Reactor Development Div., Windsor, Conn.
ANALYTICAL PROCEDURES FOR INTERPRETATION OF ROD WORTH EXPERIMENTS. J. M. Stein and H. A. Vieweg. Jan. 25, 1957. 8p. $1.80(ph OTS); $1.80(mf OTS).

The use of lumped absorbers necessitated the development and application of analytical methods to account for the depression of the neutron flux inside and adjacent to lumped absorbers in order to determine their reactivity worth in the S1C. The analytical methods described concern self-shielding and flux depression factors, the checks on these factors, and the reactivity model for calculating rod worths in the FCE. (M.H.R.)

10063 CF-51-9-71
[Oak Ridge National Lab., Tenn.]
FINAL REPORT ON BERYLLIUM FOR THE MTR. J. L. Gregg. Sept. 13, 1951. Decl. Apr. 22, 1958. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The work done to determine the type of beryllium needed for the MTR is reviewed briefly, and the character of the beryllium actually used in the reactor is described. (A.C.)

10064 CF-57-8-10
Oak Ridge School of Reactor Technology, Tenn.
SUPERHEATING WATER-BOILER. Reactor Design and Feasibility Study. F. Marbury, J. W. Alden, R. E. Bedford, J. A. Bilenas, W. C. Coppersmith, J. DeVincentis, K. Hiroshige, and O. H. Klepper. Aug. 1957. 236p. $36.30(ph OTS); $10.20(mf OTS).

A preliminary design is presented for a boiling-water reactor with integral nuclear superheater, which produces steam at 1200 psia, 950°F. The design uses stainless steel, UO_2, and water for materials and stays generally within the limits of existing reactor technology. The design output is 129,445 lbs of steam per hour at the stated conditions, which corresponds to 17,500 shaft horsepower in a naval steam plant and to 47.25 Mw of heat. This is thought of as a ship propulsion reactor, and its capacity, arrangement, shielding, and control system are appropriate to that application. The feasibility, size, and weight were studied; also the biological shielding and mechanical design were studied in relation to plant size and weight. Water treatment, mechanical design of control rod drives, and the steam plant are not considered. The reactor core is cylindrical and divided radially into three regions: a central superheater, an annular boiler, and a surrounding reflector. Moderators are BeO in the superheater and water in the boiler and reflector. Superheater fuel elements consist of three concentric tubes of type 347 stainless steel containing UO_2 particles in a stainless steel matrix. The boiler elements are of conventional plate type. (M.H.R.)

10065 CF-58-4-63
Oak Ridge National Lab., Tenn.
REVIEW OF HRT FEEDWATER CONTROL SYSTEM. R. L. Moore. Apr. 9, 1958. 28p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The HRT feedwater control system was reviewed to

determine adequacy of the present controls and to evaluate alternate systems as to feasibility and desirability. Results indicate that the present system is adequate for operation from one to five megawatts, but that trouble may be experienced below one megawatt and above five megawatts. Recommendations for improving operations of the present system are presented. Alternate systems of feedwater control are discussed. (auth)

10066 CF-58-5-26
Oak Ridge National Lab., Tenn.
MIXING RATES BETWEEN THE HRT HIGH PRESSURE SYSTEMS. H. A. McLain. May 12, 1958. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Transient effects of making step changes of the core dump tank concentration are studied for single-region operation of the Homogeneous Reactor Test. It is assumed that the feed and the letdown streams are only between the core high-pressure system and the core dump tanks, and that transfer of fuel to or from the blanket can only be made through the core high pressure system. Transfer rates between the HRT high-pressure systems of 75 to 100 lb/min will give reasonable mixing times, about 4 hours, without peaking of fuel concentration which may cause premature critical conditions in the core. Lower transfer rates could be used for lower feed rates, but the mixing time will be longer. Transfer rates greater than 100 lb/min would not shorten the mixing time appreciably and, therefore, they need not be considered. (auth)

10067 HW-51770
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
FABRICATION OF URANIUM DIOXIDE FUEL ELEMENT SHAPES BY HYDROSTATIC PRESSING. H. W. Newkirk, Jr. and R. J. Anicetti. Aug. 1, 1957. 27p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70 (mf OTS).

Hydrostatic pressing equipment and techniques are described for fabricating uranium dioxide fuel element shapes such as rods, tubes, rings, and spheres. Shapes pressed from powder as the starting material possessed a minimum of density gradients, no pressure cracks, mechanical stability, low firing shrinkage, and high green and sintered densities. Compaction ratios on pressing were 1.8 to 1. Hydrostatic re-pressing of preformed shapes decreased firing shrinkage 1 to 4%, increased green densities 7 to 10%, and increased sintered densities 2 to 6%. Hydrostatic pressing techniques are discussed for cladding uranium dioxide fuel element shapes such as spheres and for fabricating lead rods and tubes for fuel element mock-up assemblies. (auth)

10068 IDO-16003
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
MODIFICATION OF BERYLLIUM "A" AND "L" PIECES TO ACCOMMODATE IRRADIATION SAMPLES IN THE MATERIALS TESTING REACTOR. G. H. Hanson. Dec. 21, 1951. Decl. May 8, 1958. 21p. $3.30(ph OTS); $2.40(mf OTS).

Beryllium "A"- and "L"-piece locations are very attractive for sample irradiations. An illustrative design for modifying these units is presented. The principal modification involves the enlargement of the $^3/_{16}$-in. hole to $1^3/_8$-in. which accommodates standard $1^1/_4$-in. samples and provides a $^1/_{16}$-in. annulus for cooling water. Provisions are made so that either the sample stringer or beryllium plug can be withdrawn without removing the beryllium piece or both may be withdrawn as a unit. The maximum temperature rise in an "A" or "L" piece and its associated beryllium plug is small, being less than 30°F. The thermal stresses are safe. The irradiation of gram samples of Pu^{239} for the production of higher isotopes of plutonium, americium and curium for UCRL and Argonne, which may be one of the first samples irradiated in a modified "L" or "A" piece, is discussed. (auth)

10069 IDO-16045
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
THEORETICAL FORMULA FOR SHIM ROD SENSITIVITY. J. W. Webster. Nov. 24, 1952. Decl. May 8, 1958. 6p. $1.80(ph OTS); $1.80(mf OTS).

It is found that a formula for the effect on reactivity of the shim rods based on a derivation from perturbation theory considerations is in excellent agreement with experiment. In the 168-gram fuel element loading with depleted shims the theory leads to the following formula for the effect of all four shims at position s inches:

$$\frac{\delta k}{k} = -0.332\left(\frac{30-s}{30} + \frac{1}{2\pi}\sin\frac{2\pi s}{30}\right) + 0.187.$$

The excellent agreement with experiment is surprising since the hypotheses for first order perturbation theory are not at all well satisfied. (auth)

10070 IDO-16053
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
RADIATION INTENSITY FROM PNEUMATIC RABBITS. C. F. Leyse. Jan. 2, 1953. Decl. May 8, 1958. 7p. $1.80(ph OTS); $1.80(mf OTS).

The maximum radiation intensities from shuttles irradiated in the pneumatic shuttle facilities were calculated. In general, the radiation will be predominantly from the aluminum shuttle itself. However, it is possible from the heat removal point of view to irradiate quantities of various elements that would result in radiation intensities appreciably higher than that from the shuttle. The intensities could range from 2×10^3 to 30×10^3 at one foot. (auth)

10071 IDO-16446
Rand-Wooldridge Corp. Electronic Research Lab., Los Angeles.
THEORY OF POWER TRANSIENTS IN SPERT I REACTOR. Final Report. W. A. Horning and H. C. Corben. Aug. 20, 1957. 120p. For Phillips Petroleum Co. Atomic Energy Div. Contract AT(10-1)-205, Subcontract C-202. (ERL-109). $2.75(OTS).

Topics covered include: some simple models for the initial power pulse, the theory of SPERT Reactor transients (initial power pulse and small oscillations), the theory of non-linear oscillations in the SPERT Reactor, and the mechanism of heat flow during a reactor transient. The physical constants for the SPERT I Reactor are given in an appendix. (M.H.R.)

10072 IFA-ET-26
Academia R. P. R. Institutul de Fizică Atomică, Bucharest.
ON THE POSSIBILITY OF APPLYING THERMONUCLEAR REACTIONS TO ROCKET PROPULSION. (In Legătură cu Utilizarea Energiei Termo-Nucleare Pentru Propulsia Rachetelor.) I. Shechtman and E. Larisch. 1956. 22p.

It is shown that the stationary functioning of a motor based on a non-resonant thermonuclear reaction is impossible from the energy production point of view.

Assuming the existence of a resonance in the domain of energies 1 to 2 kev, the energy production rate begins to become practical at a pressure of 10^4 kg/cm^2. The temperature, however, which must be very high in the center, falls down too slowly. Some phenomena were neglected: convection and nonrealization of thermodynamic equilibrium for the reaction products. The phenomena would, however, worsen the situation creating an added energy transport and therefore decreasing the temperature gradient. (W.D.M.)

10073 LA-2142
Los Alamos Scientific Lab., N. Mex.
PRELIMINARY CRITICAL EXPERIMENTS ON A MOCK-UP OF THE LOS ALAMOS MOLTEN PLUTONIUM REACTOR. H. G. Barkmann, D. M. Holm, R. M. Kiehn, and R. E. Peterson. June 1957. 29p. Contract W-7405-eng-36. $1.00(OTS).

A series of measurements of critical masses has been made for fast-spectrum plutonium assemblies similar to proposed designs for the Los Alamos Molten Plutonium Reactor Experiment (LAMPRE I). The effectiveness of various systems of reactivity control has been determined. Fission rate distributions and spatial flux variations were obtained for comparison with values computed according to the S_n method. (auth)

10074 LA-2198
Los Alamos Scientific Lab., N. Mex.
TURRET: A HIGH TEMPERATURE GAS-CYCLE REACTOR PROPOSAL. R. Philip Hammond, Harold M. Busey, Kenneth R. Chapman, Franklin P. Durham, John D. Rogers, and W. R. Wykoff. Jan. 23, 1958. 26p. Contract W-7405-eng-36. $0.75(OTS).

A nitrogen-cooled graphite-moderated nuclear reactor experiment is proposed to drive a closed-cycle gas turbine power plant at 1300°F. The annular core of the reactor can be rotated inside the reflector to permit fuel loading and discharge while operating at full power. Small cylindrical fuel elements of graphite are solution-impregnated with partially enriched uranium. The fuel is recycled by incineration of the elements, chemical separation of the fission products, and impregnation of fresh graphite in a small batch process. The unclad, uncoated fuel should permit high burn-up and simple fuel processing, but allows fission product diffusion into the gas stream. While methods are proposed for the removal of these from the gas, the long-term consequences on turbine operation are unknown. The compatibility of nitrogen gas with the fuel has been studied experimentally. The radial movement of fuel gives a reactor with a constant power profile and no excess reactivity. The temperature is regulated by the fuel charging rate. (auth)

10075 NARF-58-18T
Convair, Fort Worth, Tex.
REACTOR POWER CALCULATOR. J. R. Gardner. Apr. 30, 1958. 23p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-136).

An electromechanical power calculator was developed for use with the Aircraft Shield Test Reactor (ASTR) and the Ground Test Reactor (GTR). The computer solves the equation, $P = Q\Delta T$, by means of a flow rate amplifier which supplies a voltage that is linear with flow rate, and a null balance servo system which produces a potentiometer shaft position that is linear with the temperature differential existing between the coolant water flowing into and out of the reactor. The computer contains its own power supply and reference supplies as well as a self-contained "Low-Flow" alarm system. One version uses 60 cycle power, while another was constructed for 400 cycle power. (auth)

10076 NDA-2084-5
Nuclear Development Corp. of America, White Plains, N. Y.
SDR PROJECT QUARTERLY TECHNICAL PROGRESS REPORT FOR THE PERIOD NOVEMBER 1, 1957 THROUGH JANUARY 31, 1958. Mar. 31, 1958. 60p. Contract AT(30-3)-256. $9.30(ph OTS); $3.60(mf OTS).

Engineering studies have continued on the through-tube reactor design. Full-scale drawings showing the units in a complete lattice position were prepared. A bellows assembly has been added to each calandria tube to accommodate possible thermal stresses. Design of the barrier system now includes a second barrier tube between the stainless steel barrier and the calandria tube. The heat loss from the sodium in the fuel tubes to the D_2O in the calandria is calculated to be less than 0.3 Mw. Studies completed during the quarter indicate that sodium-water reactions do not inherently limit the feasibility of the SDR. A careful review of the literature has shown that sodium-water systems can be designed for safety against a reaction between the two fluids. Adherence to basic safety design rules prevents shock wave formation and high temperature peaks. Adequate surge volume, low system pressures, inert gas blanketing, and oxygen exclusion are the most important of these rules. Fabrication and assembly of the apparatus for the fuel-coolant tube and header test program is nearing completion. Single-failure barrier tests were performed, using higher sodium temperatures, on six specimens of type 1100 aluminum (2S). The feasibility of using aluminum as a barrier material against hot sodium has been demonstrated. Apparatus for the multiple-failure barrier tests was installed, and a test program has been established. Detail design of the mockup test apparatus was completed. Fabrication and assembly of the apparatus at the test site is nearing completion. A test program was established which is directed at demonstrating the ability to handle sodium and water under simulated reactor temperature conditions. General studies included an investigation of reactor maintenance techniques, fuel element studies, and reactor control and core physics calculations. It was tentatively concluded that a U−10 wt. % Mo alloy is satisfactory for a slightly enriched SDR and that UO_2 is satisfactory for both a natural uranium and a slightly enriched SDR. Results of a series of two-group reactor criticality calculations indicate that a 6/1 fuel channel to control rod arrangement is satisfactory for the present design (~120 fuel tubes). A brief study was made of the advantages and disadvantages of incorporating some of the desirable features of the slab design into the present calandria design. Shielding studies were concentrated on the design requirements for the thermal shield and the bulk shield between the reactor and header rooms. Preliminary design flow sheets for the D_2O cover gas, sodium cover gas, and barrier gas systems were prepared. (For preceding period see NDA 084-3.) (auth)

10077 ORNL-2474
Oak Ridge National Lab., Tenn.
MOLTEN-SALT REACTOR PROGRAM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 31, 1958. May 14, 1958. 120p. Contract W-7405-eng-26. $2.75(OTS).

Reactor Design Studies. Preliminary layouts were

prepared of the reactor system based on the use of five fuel pumps and two blanket-salt pumps. Total power is assumed to be 638 Mw. Parameter studies of two-region molten salt reactors were continued through nuclear calculations on the UNIVAC, Oracle, and IBM-704. Comparisons of Li–Be and Na–Be salts showed that the Na–Be salt requires 1.2 to 2 times the U^{235} inventory required by Li–Be. A preliminary fill-and-drain system design was completed which satisfies design criteria. The system vessel consists of 48 20-ft lengths of 12-in.-diam pipe arranged in 6 vertical banks. A hydrostatic bearing was designed for use in fuel pumps which differs from conventional bearings in that the pockets rotate on the impeller. Pump design studies established the characteristics of the five fuel pumps for use in the BeF_2–LiF–UF_4 fueled reactor. Studies of pump arrangement and salt-lubricated pump bearings were continued. Further developments in remote maintenance techniques and testing of special flanges are reported. Heat exchanger tests are being conducted to determine the heat transfer characteristics of various salts in contact with a number of structural materials. Additional dynamic corrosion studies of INOR-8 and Inconel in fuel salts were conducted. Three proposed entrance-exit systems are being evaluated through the use of glass models; one straight-through system and two concentric-flow systems. Studies of the properties of salt systems having various compositions were continued. Preliminary studies were made of natural-convection molten-salt reactors. Comparison with forced-circulation reactors of 60-Mw indicated a 42% greater fuel inventory is required in the convection reactor. Materials Studies. Studies are under way for determining the effect of carburization on the properties of reactor structural materials. Precious-metal brazing alloys being considered for use in fused salt heat exchangers were corrosion tested in fuel mixtures. Elasticity, thermal conductivity, and tensile property measurements were made on air-melted heats of INOR-8. The sorptive properties of charcoal for Xe were significantly improved by heat treatment. Phase equilibrium studies were made of ThF_4 and UF_4 in mixtures of LiF–BeF_2. The solubility of PuF_3 in Be-containing fluoride salts was investigated. A survey was made of the properties of fused chlorides of interest as secondary heat transfer fluids. LiCl–RbCl appears most attractive. Solubility studies were made of noble gases in NaF–KF–LiF, HF in NaF–ZrF_4, and fission product fluorides in NaF–BeF_2 and LiF–BeF_2. Precipitation of fission product oxides from fluoride melts was also investigated. (For preceding period see ORNL-2431.) (D.E.B.)

10078 ORNL-2499

Oak Ridge National Lab., Tenn.

COMPARISON OF POOL-TYPE REACTOR CRITICAL EXPERIMENTS WITH TWO-GROUP AND THIRTY-GROUP CALCULATIONS. Ernest G. Silver. June 9, 1958. 32p. Contract W-7405-eng-26. $1.00(OTS).

This report contains a description of a series of two-group and multigroup calculations of the critical mass of two clean-geometry configurations of the BSR. It also contains a description of critical experiments that were done to determine the validity of the calculations. Comparison of the results indicates that the calculations described are capable of predicting the critical mass within about 2% of the measured critical mass under the favorable geometric conditions maintained in the present experiments. (auth)

10079 R-316(RAND)

RAND Corp., Santa Monica, Calif.

EXTERNALLY MODERATED REACTORS. G. Safonov. July 1957. 38p.

A reactor-statics theory is presented for a group of thermal systems having spherical symmetry. Members of the group are characterized by two basic regions: a nonmoderating interior region with fuel is surrounded by a moderating exterior. Two classes of reactor interior regions are considered. One class, which comprises the interiors of "cavity reactors," has low-density cores that cannot scatter thermal neutrons (the $U^{235}F_6$ core approximates this class of interiors). Interiors of the second class have high scattering probabilities for thermal neutrons (e.g., the cores of externally moderated liquid metal fueled reactors). Graphs are included to facilitate the analysis of general systems with external moderation. The theory is applied to criticality surveys of cavity reactors, to special features of LMFR systems, to studies of flux profiles, and to preliminary considerations of some possible applications of the externally moderated concept. (auth)

10080 UCRL-5097-T

California. Univ., Livermore. Radiation Lab.

THE PROBABILITY AND EXTENT OF A FISSION PRODUCT RELEASE FROM A POWER REACTOR. Joseph A. Fleck, Jr. Feb. 4, 1956. 23p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

The two types of accidents which could plausibly lead to a release of fission products to the atmosphere, a nuclear runaway and a loss of coolant, are discussed at length. The chemical reactions which could result from these two nuclear accidents are covered in detail. It is concluded that the chemical reaction which poses the most serious danger is the metal–water reaction. The function of vapor containers, the probability of a reactor catastrophe, and the extent of fission product release are considered. (M.H.R.)

10081 UK/C/5/110

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

POWER FLATTENING BY DIFFERENTIAL ENRICHMENT. [Paper Presented at] Fifth UK/Canada Technical Conference, October 22-24, 1956. H. Clayton and B. Davison. Sept. 1956. 14p.

Computations were recently started on the Ferut Computer in Toronto to determine the benefits to be derived from power flattening by differential enrichment. The particular reactor considered consists of three cylindrical zones, the central zone being enriched or depleted as required to provide perfectly flat power in this zone. The intermediate zone is a uniform lattice of NRX type rods with Zr sheathing (D_2O/U volume ratio = 25) which acts as a buffer zone between the central zone and the outer blanket. The blanket is a dense lattice (D_2O/U volume ratio = 5) of U^{238} in D_2O. The outer radius of the reactor is 135 cm and the height is 270 cm. Four cases are treated. They are distinguished by the thickness of blanket considered (15 or 30 cm) and the density of rods in the central zone (D_2O/U volume ratio 25 or 12.5). In each of these cases the distribution of enrichment in the central zone required to make the reactor critical and provide flat power in the central zone was studied as a function of the radius of the central zone. (auth)

10082 WAPD-MRP-73

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PRESSURIZED WATER REACTOR (PWR) PROJECT

TECHNICAL PROGRESS REPORT FOR THE PERIOD FEBRUARY 24, 1958 TO APRIL 23, 1958. 71p. Contract AT-11-1-GEN-14. $2.00(OTS).

The power and temperature controller was successfully tested under varying load changes and xenon transient conditions. Adjustment of the intermediate range of the nuclear instrumentation by modifying the detectors was completed with ion chambers now producing approximately 110 μa at full power. The cause of failure of the defective 1B steam generator tubes was attributed to stress corrosion of unknown origin but originating from the secondary side. The Seed 2 fuel loading, fuel plates and subassembly configuration were established and the fuel plates were ordered. A design investigation was initiated to determine the feasibility of adopting the present seed exit water thermocouple instrumentation concept for use with the Seed 2 metal and inlet water temperature instrumentation. The loading for Seed 2 was established at 90 kg of U^{235}. The boron loading in the outer three fuel plates on both sides of the subassembly was established at 0.039 wt. % of the fuel alloy. The test analysis for the plastic $\frac{1}{4}$-scale model of the tube design bottom support for the 20-control-rod core was completed. Thermal performance calculations were made on the 20-control-rod core throughout lifetime of the core. An "effective" thermal conductivity for a UO_2 rod of Core 1 cross section under irradiation was determined to be 1.0 ± 0.2 Btu/hr-ft-° between 300 and 1000°F. An irradiated, Zircaloy-2 base, 10 wt. % U samples clad with Zircaloy-2 swelled 213% as a result of a thermal treatment of 30 min at 760°C. No swelling was observed after a treatment of 30 min at 700°C. Four similar samples moderately swelled as a result of a 6- to 10-sec treatment at 760°C. Post irradiation metallographic examination determined that two of the CR-V-j fuel elements had been defected during a pre-irradiation corrosion test. The defects are attributed to the corrosion of stringers in the receptacle plates of one fuel element and to hydride embrittlement in other regions of the second fuel element. Excessive hydrogen pickup of high-nickel Zircaloy-2 was confirmed by out-of-pile tests; the same tests show that high-copper or high-iron contents do not cause excessive hydrogen pickup. The creep properties of Ag-base control rods can be improved by three metallurgical expedients: using of oxidized power for control rod fabrication; coarsening of grain size; increasing alloy composition to obtain a two-phase microstructure. A method for synthesizing three-dimensional power distributions from results of one- and two-dimensional calculations was developed to provide data for a re-evaluation of Core 1 thermal performance. The quantity and distribution of U^{235} and boron in a Seed 2 subassembly were examined, and the distribution of materials which minimizes the water channel peaking factors was found. A study of the relationship between blanket power fraction and mechanical design of Core 2 blanket fuel elements was completed. (For preceding period see WAPD-MRP-72.) (auth)

10083 WAPD-P-145(Rev.)

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

MINUTES OF ADVANCED REACTOR TECHNICAL MEETING NO. 8. Robert J. Creagan, ed. Nov. 15, 1951. 17p. $3.30(ph OTS); $2.40(mf OTS).

Conservation of D_2O in a heterogeneous advanced reactor was discussed on the basis of losses scaled up from those predicted for similar reactors in the past. The conclusion was that losses could be reduced to 0.05% of those predicted, by the use of reasonable equipment. This could mean a net loss of 0.1 pounds per hour. The over-all heat power considerations for using liquid metal and aqueous coolants for reactors were compared. It was concluded that over-all efficiencies could be expected as follows: 20% for liquid metal coolant, 14 to 17% for a water cooled reactor. Plant layout comparisons were discussed for the case of liquid metal and aqueous type reactors and it was concluded that while the liquid metal temperature reduces the size of the steam equipment, the shielding requirements make the liquid metal power plant heavier than an aqueous reactor to furnish the same power. The shielding problems associated with aqueous and sodium cooled reactors were compared and it was concluded that the greater specific activity in the sodium coolant required more shielding for the primary loop than in the case of aqueous coolant. One result of the primary loop activity is to preclude maintenance inside the secondary shield for minutes in the case of one previous design and for weeks in the case of another previous design. Reactor calculations of various liquid metal reactors were discussed and it was concluded that a sodium cooled, graphite moderated thermal reactor would be the most practical of this type with slightly enriched uranium used to reduce the size. Fuel costs were discussed and it was concluded that for similar fuel elements and the same burn up, fuel costs per kwh of power were higher in the case of highly enriched reactors. It was further concluded that if ORNL-1096 cost figures are correct the fuel cost figures given on page 6 of WAPD-P-130 are high. The new estimates are tabulated. A visit to Argonne, during which work on fuel plates for an aqueous heterogeneous reactor was observed, was reported on. The conclusion was that plates are not as feasible as rods for a fuel element. (auth)

10084 WAPD-P-687

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

IRRADIATION OF PLASTIC FUEL TAPES, PART IV. Phyllis A. Nicoll and E. R. Sanford. Sept. 1955. Decl. May 5, 1958. 20p. $3.30(ph OTS); $2.40(mf OTS).

The current tests show that when unclad polyethylene tape (46.4 wt. % U_3O_8, 93.2% enriched) is irradiated to a given integrated flux under helium pressure, the resultant expansion decreases with increased pressure. The greatest limitation of expansion is produced by the first 100 psi. Unclad tape (57 wt. % U_3O_8, 93.2% enriched) irradiated at atmospheric pressure appears to expand more than the standard tape under the same conditions. Gold foil flux monitor data gives a cadmium ratio of 3.77 and a thermal neutron flux of 1.94×10^{12} neutrons/cm^2-sec at 25 Mw. (For preceding period see WAPD-P-659.) (auth)

10085 WAPD-T-608

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THREE-DIMENSIONAL POWER SHAPES: III. CALCULATION OF THERMAL DESIGN CRITERIA. Carl M. Friedrich and John E. Meyer. Oct. 1957. 32p. Contract AT-11-1-GEN-14. $6.30(ph OTS); $3.00(mf OTS).

For presentation at American Nuclear Society Meeting, October 28-31, 1957, New York City.

The development of digital computer techniques for generation of three-dimensional power distribution information has produced an unwieldy amount of data. This mass of information must be used to evaluate such important thermal criteria as maximum metal surface temperature, minimum burnout ratio, and maximum

water enthalpy rise. A first step in such an analysis must be to select limited regions of the core for detailed analysis. The use of high-speed digital computers for selection of such regions and the procedures for calculation within these selected regions are discussed. (auth)

10086 WAPD-TM-100

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CRITICAL EXPERIMENTS IN A URANIUM–ZIRCONIUM WATER-MODERATED CORE WITH PLATE FUEL ELEMENTS AND SLAB GEOMETRY. W. F. Vogelsang and R. G. Serenka. Dec. 1957. 42p. Contract AT-11-1-GEN-14. $1.25(OTS).

Experiments were performed on light-water-moderated, highly enriched uranium–zirconium–aluminum cores in slab geometry. In one case, light water was used as a reflector on all sides of the core. In the second, a metal and water reflector containing natural uranium–niobium–aluminum was symmetrically added to a thinner, enriched uranium–zirconium–aluminum slab core. Experimental flux plots and machine calculated flux plots agreed within the experimental and calculational uncertainties. Few-group slowing-down models combined with spatial diffusion theory were used to predict criticality of the assemblies to within 2% in the worst case. The four-group slowing-down model, incorporating the effects of changes in the thermal flux spectrum, gave the best results. (auth)

10087 WKNL-98

Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.
NUCLEAR STUDIES FOR THE NUCLEAR-POWERED MERCHANT SHIP. W. C. Bartels. Aug. 2, 1957. 87p. For George G. Sharp, Inc. Subcontract under Contract MA-1348.

Studies performed to aid in the design of the first nuclear-powered merchant ship are reported. The reactor proper is not dealt with, but rather the effect of such a power plant on ship design requirements. The normal reactor power level is 69 Mw. The pressurized water reactor is fueled with slightly enriched U in the form of oxide rods. The average primary water temperature is 500°F and the design pressure is 2000 psi. Studies on the reactor and coolant-loop shielding are presented. Allowable radiation levels are discussed, the shielding philosophy is outlined, and the shielding requirements are presented along with the resulting radiation levels. The reactor and its auxiliaries are surrounded by a containment vessel (secondary shield), and also around the reactor proper (primary shield). The secondary shield design, and optimization between primary and secondary shields, are the chief concern here. Some of the consequences of reactor failures are discussed. The mechanisms which lead to failures are not analyzed. The studies were made primarily to ascertain that radiation levels following various failures would not be excessive and that the containment vessel would remain intact. The radioactive materials that must be handled in a more or less routine manner are listed and the associated handling hazards are considered. The calculational methods are presented in appendices. (M.H.R.)

10088 YAEC-65

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
QUARTERLY PROGRESS REPORT FOR THE PERIOD JANUARY 1, 1958 TO MARCH 31, 1958. I. H. Coen and R. W. Garbe. Apr. 30, 1958. 96p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $15.30(ph OTS); $5.40(mf OTS).

Abbreviated press feed preparations of UO_2 powder appear suitable for the automatic pressing of pellets on a production scale. Progress was made in achieving compartment uniformity in disc-compartmented stretch-formed fuel tubes and controlling the free space for pellet expansion within the compartments. The designs for additional in-pile and out-of-pile test specimens were completed. A reference control rod program was developed on the basis of "outside-in" rod withdrawal in order to approach uniform fuel burnup and fission product buildup in the core. Stainless steel specimens suffered no detrimental attack as a result of their exposure to borated water under simulated reactor conditions in a dynamic test loop. The successful fabrication of a full-size strap design fuel assembly model demonstrated the feasibility of welding tubes into bundles. Pressure drop versus flow curves were experimentally determined for the reactor vessel model. Various fuel loadings in the CRX core were used in materials buckling measurements, control rod worth determinations, and instrumentation evaluations. The latest revisions of mechanical, thermal, and nuclear design data are appended. (For preceding period see YAEC-52.) (D.E.B.)

10089 YAEC-70

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
MONTHLY PROGRESS REPORT FOR THE PERIOD APRIL 1, TO 30, 1958. I. H. Coen and R. W. Garbe. May 20, 1958. 15p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph OTS); $2.40(mf OTS).

The status of the research and development of the Yankee Power Reactor is briefly summarized. (For preceding period see YAEC-66.) (M.H.R.)

10090 NP-tr-81

APPLICATION OF ATOMIC ENGINES IN AVIATION. (Primeneniye Atomnykh Dvigateley v Aviatsii). G. N. Nesterenko, A. I. Sobolev, and Yu. N. Sushkov. Translated from a publication of the Military Press of the Ministry of Defense of the U.S.S.R., Moscow, 1957. 187p.

The scattered data in the literature on the utilization of atomic power plants in aviation and rocket engineering are systematized and reviewed in popular form. The range of aircraft using chemical and nuclear fuels, the two major methods of obtaining nuclear energy, a comparison of the world resources of chemical and nuclear fuels, and the first concept of atomic aircraft engines are discussed. The principles of reactor engineering and the various types of reactors are dealt with in an elementary manner. The possible types of nuclear aircraft power plants are divided into three major groups: rocket engines; three types of ramjet engines: true athodyds, turbocompressor engines, and motor-driven compressors; and turboprop engines. The most typical designs of nuclear aircraft power plants are reviewed and the possibilities of their application are discussed. (M.H.R.)

10091

P_3 APPROXIMATION FOR THE CALCULATION OF THE THERMAL UTILIZATION. H. Engel. Atomkern-Energie 3, 129-33(1958) Apr. (In German)

The calculation of the thermal utilization by ordinary diffusion theory is a somewhat rough approximation. Absorption and anisotropic scattering of neutrons should be taken into account by a better method. In the special case of plane geometry and isotropic scattering in the laboratory system an analytic expression can be found for the thermal utilization by a P_3 approximation. Comparison between the P_3 approximation and diffusion

theory shows however, that the accuracy of the latter is sufficient. (auth)

10092

STEAM-COOLED POWER REACTOR. A. Schraud. Atomkern-Energie 3, 133-6(1958) Apr. (In German)

A special possibility to use a steam cooled reactor in a nuclear power station is described. Water steam as a coolant is superheated by passing through a heterogeneous reactor. At the outlet such an amount is bled off to the turbine plant, that the remaining steam can be cooled back to the entrance temperature by mixing it with the turbine condensate. As an example, results of a preliminary design study for a 20 Mw plant are given. The reactor is moderated by light water and uses enriched uranium oxide in stainless steel tubes as fuel. The net power costs of the plant are estimated to be 5.7 Pf per kwh. (auth)

10093

MATERIAL AND CORROSION PROBLEMS IN THE REACTOR WITH LIQUID METALS AS COOLANT. Willibald Machu (Universität Cairo). Atomkern-Energie 3, 141-4(1958) Apr. (In German)

The last part in a series on material and corrosion problems in liquid metal cooled reactors is presented. The behavior of reactor materials in liquid bismuth, lead, and mercury is described. The corrosion mechanism of liquid metals is briefly discussed. (J.S.R.)

10094

THE REACTOR PROJECT GEESTHACHT. Erich Bagge. Atomkern-Energie 3, 169-75(1958) May. (In German)

A survey is given of the building and the special technical precautions for the operation of the Geesthacht research reactor in Hamburg sponsored by the Association for the Utilization of Nuclear Energy in Ship Building and Navigation. It is a 5 Mw swimming pool reactor with MTR-type fuel elements. (J.S.R.)

10095

THE PROBLEMS OF MATERIALS IN DEVELOPING HIGH EFFICIENCY NUCLEAR POWER PLANTS. J. Vrtel. Jaderna Energie 4, 80-4(1958). (In Czech.)

Studies were made of the efficiency, fuel costs, and fuel availability for various type reactors. Comparisons are made of reactors in operation in power plants of U.S.S.R., U.S.A., Britain, Canada, and France. (R.V.J.)

10096

INSTRUMENTATION, 1958. Nuclear Power 3, 148-86 (1958) Apr.

An over-all picture of the instrumentation requirements of modern nuclear power and research reactor installations and a review of the latest British instruments available to meet them are given. Five review articles by the country's leading authorities are included. These cover physical or non-nuclear instruments needed in a power station, lines of development for instrumentation, methods of neutron detection by means of gas ionization devices, scintillation counting methods, and methods of finding neutron flux variations. Diagrams are included showing the main instrumentation features in a gas-cooled power station, a high-flux reactor, and a fast breeder reactor. Preview features of two exhibitions in London—the Physical Society and the Instruments, Electronics, and Automation exhibitions—are included. (M.H.R.)

10097

KINETICS OF HOMOGENEOUS POWER REACTORS OF THE LAPRE TYPE. John C. Allred and David S. Carter (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 3, 482-503(1958) May.

A theoretical study of the kinetics of a model of the Los Alamos Power Reactor Experiments (LAPRE) has been made through integration of the dynamic equations with the IBM 701 computer. The stability is investigated under various conditions of power demand, rod-induced reactivity changes, and other conditions especially applicable to reactors of the LAPRE type. The results are given in graphical form, along with conclusions as to appropriate conditions of operation. (auth)

10098

TWO-GROUP DIFFUSION THEORY FOR A RING OF CYLINDRICAL RODS. R. Avery (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 504-13 (1958) May.

The conditions for criticality and resulting flux distribution are obtained in the two-group diffusion theory approximation for a ring of N equally spaced identical cylindrical rods embedded symmetrically in a radially bare cylinder. The system is uniform axially and of either finite or infinite height. Either or both of the two media of the system may be multiplying. The method used is a generalization of the Nordheim-Scalettar method for the solution of the control rod problem of similar geometry. In satisfying each of the various boundary conditions, use is made of the Bessel function addition theorems to center all terms in the general solution at the appropriate line of symmetry. The results are obtained in terms of a Fourier expansion of the angular dependence of the flux about each rod, which in application must be cut off after some early term in the infinite series. The order of the critical determinant is equal to twice the number of angular terms retained. (auth)

10099

REMOVAL OF DECAY HEAT FROM A PLATE-TYPE FUEL SUBASSEMBLY IN THE ATMOSPHERE. R. E. Grimble and B. W. LeTourneau (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 3, 529-39 (1958) May.

An analysis is made in order to estimate how much heat may be removed from a fuel element subassembly in air. The two following cases are considered: (1) the reactor core as a whole is exposed to the atmosphere while the individual subassemblies remain in place; and (2) the subassembly in question has been removed from the core and is individually exposed to the atmosphere. (auth)

10100

THERMAL STRESSES IN EXTERNALLY CLAD CYLINDRICAL FUEL ELEMENTS. C. O. Smith (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 3, 540-7 (1958) May.

Equations for the thermal stresses developed in externally clad cylindrical fuel elements with radially symmetric temperature distribution are presented. The stresses developed in both a solid and a hollow fuel element under a given set of conditions are calculated and shown as an application of the equations. (auth)

10101

REACTOR RESPONSE TO REACTIVITY CHANGES DURING A XENON TRANSIENT. H. L. Garabedian, R. S. Varga, and G. G. Bilodeau (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 3, 548-72 (1958) May.

The response of a thermal reactor to a ramp change of reactivity is studied. When a single group of delayed

neutrons is assumed, the differential equations for the time dependence of the thermal neutron flux takes the form of a linear homogeneous differential equation of the the second order with linear coefficients. Linearly independent solutions of the differential equation are found in the form of contour integrals. Moreover, expansions of these contour integrals into usable asymptotic developments are determined. Application of the mathematical results obtained is made to the problem of control rod calibration during a xenon transient. (auth)

10102

A PULSED NEUTRON TECHNIQUE FOR REACTIVITY DETERMINATION. B. E. Simmons and J. S. King (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 3, 595-608(1958) May.

If a burst of neutrons is injected into a reactor, the rate of prompt decay of the resultant flux should be proportional to the reactivity in dollars as measured from prompt critical. The proportionality constant is the ratio of the effective delayed neutron fraction to the prompt neutron generation time and can be determined by pulsing the reactor at (delayed) critical. Experiments with distributed poison in several highly enriched, hydrogen-moderated critical assemblies indicate that such pulsed reactivity measurements are reliable at least as far as $|\Delta k| = 12\beta$, i.e., \$12, subcritical. No sensitivity of the technique to counter position has been found, even with a very nonuniformly poisoned reactor. Generation times have been derived from experimental results by assuming a value for the effective delayed neutron fraction. (auth)

10103

A HIGH-FREQUENCY REACTOR INSTABILITY MECHANISM. Richard B. Nicholson (Atomic Power Development Associates, Inc., Detroit). Nuclear Sci. and Eng. 3, 620-7(1958) May.

An analysis has been made of a possible mechanism of reactor instability due to interaction of the effects of longitudinal vibration of the fuel elements, heat generation, thermal expansion, and neutron kinetics. The analysis shows that under certain conditions, if there were no frictional damping forces, an instability would exist in a reactor of the type that has solid fuel elements that run continuously the length of the core. Self-sustained oscillations would build up until the fuel elements were stressed beyond their yield point. It is further shown that the frictional damping must be greater than a certain critical value to prevent an instability of this type. The Enrico Fermi Fast Reactor, taken as an example, is found to have sufficient damping to assure that the instability will not exist. (auth)

10104

CRITICAL EQUATIONS FOR FINITE CYLINDRICAL REACTORS. G. W. Stuart (General Electric Co., Pleasanton, Calif.). Nuclear Sci. and Eng. 3, 628-30 (1958) May.

The construction of critical equations for reflected finite cylinder reactor cores in integral equation (and variational principle) form necessitates the evaluation of integrals over the finite cylinder. Use of the momentum space variety of variational principle introduced by Francis et al. (Nuclear Sci. and Eng. 2, 253-87 (1957)) permits evaluation of such integrals. The special case of a finite cylinder reactor core, light water moderated and reflected, is considered. (J.S.R.)

10105

REACTOR CONTROL PHILOSOPHIES. M. A. Schultz (Westinghouse Electric Corp., Pittsburgh). Nucleonics 16, No. 5, 62-5(1958) May.

Reactor control philosophies are discussed in terms of safety in startup and shutdown, and economy and efficiency in operation. (W.D.M.)

10106

TODAY'S CONTROL DESIGN. John MacPhee (AMF Atomics, Greenwich, Conn.). Nucleonics 16, No. 5, 66-70(1958) May.

Inherent and external feedback systems are used to solve four important problems of reactor behavior: startup, stability, transient response, and programming. (W.D.M.)

10107

REACTOR CONTROL STRATEGIES. Nucleonics 16, No. 5, 71-7(1958) May.

Operational control strategies for power reactors are dictated by reactor type but are implemented in many ways. When grouped by reactor type, they are seen to follow generic lines. A summary of power reactor control approaches is presented in tabular form. (W.D.M.)

10108

A LOOK AHEAD TO TOMORROW IN POWER REACTOR CONTROL. E. R. Mann (Oak Ridge National Lab., Tenn.). Nucleonics 16, No. 5, 78-9(1958) May.

Some rules are laid down to indicate the probable direction of reactor development in order to predict what lies ahead in power reactor control. (W.D.M.)

10109

SPECTRAL SHIFT CONTROL. M. C. Edlund and G. K. Rhode (Babcock & Wilcox Co., Lynchburg, Va.). Nucleonics 16, No. 5, 80-1(1958) May.

The control of reactivity in pressurized-water reactors by continuous adjustment of the D_2O-H_2O ratio appears to offer significant advantages. First the reactivity lifetime for close-packed water cores can be extended beyond 30,000 Mwd/ton without sacrificing the conversion ratio. The flexibility gained in choice of fuel cycle and initial fuel loading permits cost optimization throughout the power-plant life. Since there are no control rods, the power distribution can be made more uniform. For instance, with nonuniform fuel loading the maximum-to-average power distribution can be reduced to 1.5 to 1.6. (auth)

10110

FLUID POISON CONTROL OF BOILING WATER REACTORS. J. A. Thie (Argonne National Lab., Lemont, Ill.). Nucleonics 16, No. 5, 82-3(1958) May.

Using boric acid poison rather than control rods promises lower capital cost, simpler maintenance, ready control of large reactivities, freedom from rod placement problems, and elimination of rod hot-spot factors in boiling water reactors. The amount of reactivity held down by the acid varies, but is of the order of 3%. The boric acid is added to the reactor by dissolving in hot water, inserting into a special tank isolated from reactor pressure, injecting into the reactor water and flushing the tank, and circulating the reactor water extensively to insure thorough mixing. Four methods are used to determine the concentration: calculation, titration, neutron absorption, and control rod motion. (W.D.M.)

10111

CONTROL ROD DRIVES. W. J. Kann and J. M. Harrer (Argonne National Lab., Lemont, Ill.). Nucleonics 16, No. 5, 84-5(1958) May.

The advantages and disadvantages of the design of the Army Package Power Reactor-1, the Shippingport Pressurized Water Reactor, the Experimental Boiling Water Reactor, and the Vallecitos Boiling Water Reactor are discussed. (W.D.M.)

10112

SPECIAL SAFETY DEVICES. N. E. Huston and N. C. Miller (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 16, No. 5, 86-7(1958) May.

The four ways to shut down a reactor—by increasing parasitic absorption, increasing neutron leakage, decreasing moderation, and decreasing fuel content of the core—are reviewed. (W.D.M.)

10113

CONTROL ROD MATERIALS. D. N. Dunning and W. E. Ray (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 16, No. 5, 88-92(1958) May.

Reactor control rod materials are discussed in terms of radiation damage resistance, corrosion resistance, mechanical strength, metallurgical stability, fabricability, and availability in suitable quantities. Comparative costs for various types of fabricated control rods are given. All rods are designed to meet service requirements in water-cooled, water-moderated reactor cores operating at 500° to 625°F. (W.D.M.)

10114

SCINTILLATION-COUNTER ANALYSIS OF EBWR RADIOACTIVITY. S. J. Goslovich, J. H. Pingel, and H. R. Fish (Argonne National Lab., Lemont, Ill.). Nucleonics 16, No. 5, 94, 96-7(1958) May.

During full power runs of the Experimental Boiling Water Reactor in January 1957 abnormally high air activity inside the shell was noted from Cs^{138}. A systematic study of various reactor media was begun. Air-ejector gas, condensed steam, and reactor-water samples were analyzed in bulk form by scintillation-counting methods. The activities that have been identified to date are summarized in tabular form. The ratio of concentration to maximum allowable concentration for those isotopes present in sufficient quantity is also listed. All activity levels were determined after the reactor had operated at 20 Mw for at least 24 hr. All activities listed result from xenon and krypton, gaseous fission products. These gases escape through the Zircaloy cladding by diffusion and enter the reactor water and steam. (W.D.M.)

10115

XENON-POISONING COMPUTER. J. J. Paul and J. R. G. Cox (Sperry Gyroscope Co. of Canada, Ltd., Montreal). Nucleonics 16, No. 5, 97-101(1958) May.

A computer was built for use with the NRU reactor to solve the problem of Xe^{135} concentrations. The effect of any changes in reactor on Xe^{135} concentration can be predicted and steps taken to avoid poisoning out. An electromechanical system was used for the computer to avoid the inherent disadvantages that electronic analog computers present for problems of very long solution times. The electromechanical analog computer has a high order of reliability and contains no vacuum tubes, commutators, slip rings, relays, or aluminum electrolytic capacitors. It is insensitive to transient disturbance. In the event of failure of components or interruption of line voltage, it will retain existing information. The computer was designed for ~1% accuracy in Xe^{135} concentration readings. (W.D.M.)

10116

GAS-COOLED REACTOR FOR THE SOUTH OF SCOTLAND ELECTRICITY BOARD. P. J. Grant (General Electric Co., Ltd., Erith, Kent, Eng.). Nucleonics 16, No. 5, 108-13(1958) May.

In the Hunterston reactors, the 32,880 natural uranium fuel elements (1.15 in. diam × 24 in.) will be contained within a pile of graphite, and the heat generated will be transferred by circulating CO_2 under pressure. The elements consist of rods of natural uranium metal sealed in a magnesium alloy can that has heat transfer fins on its outer surface. The lattice properties were computed by standard methods and are based on exponential and fine-structure measurements. The core dimensions represent a compromise between the physical requirement of minimum over-all neutron leakage and the demand, from the heat-transfer aspect, that the gas channels should be as short as possible to minimize the pumping power. There are 208 control-rod channels in all, one in the center of each group of 16 fuel elements. The double shell construction of the containment shell eliminates the need for a thermal shield. Possible methods of fuel cycling are discussed. (W.D.M.)

10117

TEMPERATURE-ZONED REACTOR. F. H. Clark and C. N. Klahr (Technical Research Group, New York). Nucleonics 16, No. 5. 114-17(1958) May.

The temperature-zoned reactor system attempts to improve nuclear power economics by supplying reactor heat at two different temperatures. The reactor core consists of two zones that are neutron-coupled but isolated in temperature from each other. The high-temperature zone, which produces only a small fraction of the total heat, is used to superheat steam produced by the lower zone. Separate coolant streams are used. Two temperature-zoned reactor applications have been studied: a Calder Hall type modified to produce high-temperature heat with conventional materials while retaining natural uranium as fuel, and pressurized water types operating at either lower pressure or higher power density than conventional designs. (W.D.M.)

Nuclear Transformation

10118 NP-6677 (Rpt: UNCLASSIFIED)

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

DEUTERON STRIPPING ON SPHEROIDAL NUCLEI. Report No. 4/VII. J. Sawicki. Dec. 1957. 14p.

An explanation is proposed of the effect of mixtures of two or more values in (d,p) stripping angular distributions from the point of view of the spheroidal nuclear model. S. G. Nilsson's wave functions are employed to represent the captured neutron. General properties of the cross sections and selection rules are discussed. Qualitative agreement is obtained for (d,p) reactions on Mg^{25} and Al^{27} targets. Angular γ-p correlations are discussed on γ rays following (d,p) stripping reactions. Polarization of the outgoing protons is calculated. (auth)

10119 AEC-tr-3228

THE NUCLEAR REACTION, Li^6 (nt) He^4. T. I. Kopaleishvili. Translated from Zhur. Eksptl'. i Teoret. Fiz. 33, 788-90(1957). 5p.

The problem of the energy dependence of the total cross section of the process is investigated. The d-α interaction in the Li^6 nucleus is taken in the form of an oscillator potential rather than the potential well. In the matrix element, the neutron-deuteron interaction energy is not replaced by the deuteron-alpha interaction energy but is taken in the well form. For the wave function of the ground state of the deuteron the ordinary expression is selected, while for the triton an expression previously used is selected. From these hy-

potheses in the Bohr approximation, an expression for the total cross section is obtained. (M.H.R.)

10120

EXCITATION CURVE FOR THE REACTION $P^{31}(n,p)Si^{31}$. Susumu Morita (Kyushu Univ., Fukuoka, Japan). J. Phys. Soc. Japan 13, 431-3(1958) May.

The excitation curve for the reaction $P^{31}(n,p)Si^{31}$ was measured in the neutron energy range from 3.0 to 5.2 Mev by activation method. A large resonance peak of 160 mb was found at the neutron energy of 4.9 Mev. (auth)

10121

PHOTOPROTONS FROM OXYGEN. C. Milone, S. Milone-Tamburino, R. Rinzivillo, and A. Rubbino (Istituto di Fisica dell'Universita and Centro Siciliano di Fisica Nucleare, Catania) and C. Tribuno (Istituto di Fisica dell'Universita and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 7, 731-41(1958) Mar. 16. (In Italian)

The $O^{16}(\gamma,p)$ reaction has been studied by exposure of an oxygen gas target to the γ rays of a betatron of 31-Mev maximum energy. Exposures at 23, 26, and 30 Mev have been made. The uncertainty for the half-thickness of the target goes from 0.15 Mev for 2-Mev protons to 0.02 Mev for 15-Mev protons. The spectra at 23, 26, and 30 Mev show the same proton groups found by Cohen and others. From the experimental spectra the cross section for decay in the fundamental state of N^{15} is obtained, and a giant resonance in photon absorption at E_γ = 22 Mev is found. The spectra show a fine structure with well resolved peaks at 18.8, 19.3, 20.6, 22.2, and 25.5 Mev. The yield up to 30 Mev is about 20% higher than the yield below 26 Mev. (W.D.M.)

10122

RESONANT ABSORPTION OF GAMMA RADIATION FROM THE $Al^{27}(p,\gamma)Si^{28}$ REACTION. P. B. Smith and P. M. Endt (Rijksuniversiteit, Utrecht). Phys. Rev. 110, 397-402(1958) Apr. 15.

Gamma rays emitted by excited Si^{28} formed in the reaction $Al^{27}(p,\gamma)Si^{28}$ at E_p = 771 kev have been selectively absorbed in silicon. Selective, or resonant, absorption occurs when the absorber is placed at such an angle that the loss of energy upon emission and reabsorption of the photons is restored by the Doppler shift resulting from the forward motion of the excited Si^{28} nucleus. A narrow slit in a lead collimator is filled with silicon powder, and the transmitted gamma radiation is detected by a scintillation counter. The absorption dip observed as the collimator is rotated through the resonant angle has a width of 0.75 degree, the maximum absorption amounting to 21%. From the integral of the absorption as a function of angle, and from an absolute measurement of the (p,γ) integral cross section, the radiation width for transition to the ground state (E_γ = 12.33 Mev) is determined to be 5.2 ± 0.5 ev, while 2.0 ± 0.5 ev is found for the proton width, and 9.0 ± 0.8 ev for the total width. The half life calculated from the latter is $(4.5 \pm 0.4) \times 10^{-17}$ sec. These values, together with the angular distribution of the ground-state radiation, are consistent with a 1^+ assignment to the resonance level. (auth)

10123

NEUTRON ACTIVATION CROSS SECTION OF TECHNETIUM-98. Edward Anders (Univ. of Chicago). Phys. Rev. 110, 427-30(1958) Apr. 15.

The cross section for the reaction $Tc^{98}(n,\gamma)Tc^{99m}$ was determined by thermal neutron irradiation of a cyclotron-produced sample containing Tc^{95}, Tc^{97m}, Tc^{97g}, Tc^{98}, and Tc^{99}. The degree of selectivity and background reduction required to permit an accurate measurement of the Tc^{98} content, 2.68 ± 0.54 disintegrations per minute, was attained by means of β-(740-kev γ) coincidence counting. At a thermal flux of 2.1×10^{12} neutrons cm^{-2} sec^{-1}, a saturation activity of 375 ± 85 dis/min Tc^{99m} per dis/min of Tc^{98} was obtained. Using the latest value of the half life of Tc^{98}, $(1.5 \pm 0.7) \times 10^6$ years, one finds a cross section of 2.6 ± 1.3 barns. Relative cross sections are also given for the production of several technetium isotopes by bombardment of molybdenum with 10.2-Mev deuterons. (auth)

10124

POLARIZATION OF PROTONS FROM (d,p) REACTIONS ON C^{12} AND Si^{28}. A. C. Juveland and W. Jentschke (Univ. of Illinois, Urbana). Phys. Rev. 110, 456-61 (1958) Apr. 15.

The polarization of five proton groups from the reactions $C^{12}(d,p)C^{13}$ and $Si^{28}(d,p)Si^{29}$ has been measured at several proton angles at a deuteron energy of 11.9 Mev. In the case of the carbon ground-state group, the sign of the polarization agrees with the measurement of Hillman using 4.05-Mev deuterons and with the calculations of Cheston for 3.29-Mev deuterons. The largest value of the polarization was measured for the carbon ground-state group, with the value −0.49 ± 0.13 at a proton angle of 69.0°. At small proton angles there is for the l_n = 1 proton groups a consistent correlation between the sign of the polarization and the relative orientation of the spin of the captured neutron and its orbital angular momentum. (auth)

10125

PROMPT NEUTRON EMISSION FROM SPONTANEOUS-FISSION MODES OF Cf^{252}. William E. Stein and Stanley L. Whetstone, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 110, 476-84(1958) Apr. 15.

The number of prompt neutrons emitted and the velocities of the fragment pairs have been measured for individual spontaneous fissions of Cf^{252}. The time-of-flight measurements of the fragment velocities have sufficient resolution to provide a good determination of the mode of fission as characterized by the total kinetic energy E_K and the mass ratio R_A of the fragments. The neutrons are detected with high efficiency in a large cadmium-loaded liquid scintillator. It is found that the dependence of the average number of neutrons per fission, $\bar{\nu}$, on the parameters E_K and R_A may be approximated by a plane $\bar{\nu}(E_K,R_A)$ over the region that includes the majority of the fission events. The slopes that specify the orientation of this plane are determined to be $\partial\bar{\nu}(E_K,R_A)/\partial E_K = -0.143 \pm 0.020$ (neutrons/fission)/Mev and $\partial\bar{\nu}(E_K,R_A)/\partial R_A = -6.3 \pm 1.1$ (neutrons/fission)/unit mass ratio. The value of the first slope indicates that the average total excitation energy of the fragments, required for the emission of one more neutron on the average, is 7.0 ± 1.0 Mev. From this number and the measured dependence of $\bar{\nu}$ on mass ratio, the average excitation energy $\bar{E}_X$ of the fragments is determined as a function of the mass ratio. This function $\bar{E}_X(R_A)$ and the measured dependence $\bar{E}_K(R_A)$ determine the average prompt energy of fission as a function of mass ratio. The widths of the neutron-number distributions have been obtained as functions of E_K and R_A. The data do not support the statistical theory of fission proposed by Fong. (auth)

10126

GROUND-STATE DOUBLET OF P^{32}. W. C. Parkinson (Univ. of Michigan, Ann Arbor). Phys. Rev. 110, 485-8 (1958) Apr. 15.

Angular distributions obtained for each member of the ground-state doublet of P^{32} in the reaction $P^{31}(d,p)P^{32}$ indicate that for both levels the neutron is captured with $l_n = 2$, and that the s-wave admixture for the ground state is about 5%. Estimates of the purity of the P^{31} ground-state wave function are made on the basis of the available experimental data. (auth)

10127

CONSIDERATIONS ON THE PROBABILITY OF NUCLEAR FISSION. Robert Vandenbosch and Glenn T. Seaborg (Univ. of California, Berkeley). Phys. Rev. 110, 507-13(1958) Apr. 15.

A semiempirical equation for fission thresholds has been extended to include the effects of unpaired nucleons on the rate of spontaneous fission. Excitation functions for the $(\alpha,4n)$ reactions of Ra^{226}, Th^{230}, and U^{238} have been measured. These results and reported cross sections for other $(\alpha,4n)$ reactions in the heaviest elements have been analyzed in terms of fission and neutron-emission competition to obtain mean values of Γ_n/Γ_F. These mean values of Γ_n/Γ_F have been correlated with neutron binding energies and fission thresholds. (auth)

10128

ENERGY SPECTRUM OF ALPHA PARTICLES FROM $Li^7 + d$ AT $E_d = 1.0$ Mev. Gustav Weber (California Inst. of Tech., Pasadena). Phys. Rev. 110, 529-31 (1958) Apr. 15.

The high-energy part of the alpha spectrum emitted in the bombardment of Li^7 with deuterons, was measured with a magnetic spectrometer at $E_d = 1.0$ Mev and $\theta = 90°$. For the $Li^7(d,\alpha)He^5$ (ground state) reaction, a Q value of 14.11 ± 0.08 Mev is obtained. The spectrum yields level parameters for the ground state of He^5 which are consistent with those known from n-α scattering data. No definite evidence for an α group corresponding to an excited state of He^5 was found. (auth)

10129

MEASUREMENTS OF (n,α) CROSS SECTIONS AT 14 Mev. H. G. Blosser, C. D. Goodman, and T. H. Handley (Oak Ridge National Lab., Tenn.). Phys. Rev. 110, 531-3(1958) Apr. 15.

Results of activation measurements of the (n,α) cross section of nine isotopes ranging in mass number from 59 to 133 are reported. The measurements were made at a neutron energy of 14 ± 0.5 Mev using neutrons from the $D(t,n)He^4$ reaction. The cross sections show a markedly different dependence on mass number from that reported in a previous survey. (auth)

10130

A STUDY OF THE REACTION OF He^3 WITH DEUTERONS. A. P. Kliucharev, B. N. Esel'son, and A. K. Val'ter (Physicotechnical Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 1, 475-7(1956) July-Aug.

The excitation function of the $He^3(d,p)He^4$ reaction was studied, and the absolute cross section of the reaction was measured. The apparatus for deuteron acceleration and the target chamber and counter are described in detail. The results show that the excitation function has a resonance peak at a deuteron energy of 435 ± 30 kev. The resonance indicates that the reaction proceeds with the formation of a compound Li^5 nucleus with an excitation level at 16.8 Mev. The absolute value of the cross section at resonance was 63.4 ± 3.2 mb per steradian. (J.S.R.)

10131

SHORT-LIVED ISOMERS FROM PROTON BOMBARDMENT. O. I. Leipunskii, V. V. Miller, A. M. Morozov, and P. A. Yampol'skii (Inst. of Chemical Physics, Academy of Sciences, USSR). Soviet Phys. (Doklady) 1, 505-7(1956) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 2149.

10132

YIELD OF CALIFORNIUM ISOTOPES PRODUCED IN REACTIONS BETWEEN CARBON IONS AND URANIUM NUCLEI. Yu. B. Gerlit, L. I. Guseva, B. F. Miasoedov, N. I. Tarantia, K. V. Filippova, and G. N. Flerov (Academy of Sciences, USSR). Soviet Phys. JETP 6, 263-5(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3322.

10133

ON THE CROSS SECTION FOR PRODUCTION OF MULTIPLY CHARGED PARTICLES IN THE INTERACTION BETWEEN PROTONS AND NUCLEI. O. V. Lozhkin (Radium Inst. of the Academy of Sciences, USSR). Soviet Phys. JETP 6, 273-5(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3323.

10134

THE EFFECTIVE CROSS SECTION OF THE $Be^9(n,2n)$ REACTION. S. S. Vasil'ev, V. V. Komarov, and A. M. Popova (Moscow State Univ.). Soviet Phys. JETP 6, 411-12(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3324.

10135

PHOTO-DISINTEGRATION OF Be^9 AND C^{12} BY γ-BREMSSTRAHLUNG OF 44 Mev MAXIMAL ENERGY. I. V. Chuvilo and V. G. Shevchenko (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 593-8(1958) Mar. (In Russian)

Results of investigation of angular and energy distributions of protons produced in the photodisintegration of Be^9 and C^{12} are presented. Analysis of the results indicates that in the region of giant resonances the interaction between γ quanta and the investigated nuclei can be satisfactorily explained by the resonance theory of the intermediate nucleus. At energies above the giant resonance the γ quanta predominantly interact with separate structures within the nuclei. (tr-auth)

10136

ON THE THEORY OF PHOTONUCLEAR REACTIONS. V. M. Agranovich and V. S. Stavinskii. Zhur. Eksptl'. i Teoret. Fiz. 34, 700-6(1958) Mar. (In Russian)

Calculations were made of the cross section of γ quanta capture by nuclear matter in the energy range corresponding to large resonance. (tr-auth)

Particle Accelerators

Refer also to abstract 10273.

10137 AERE-G/M-132

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FURTHER NUMERICAL INVESTIGATIONS OF SOME OF THE PROPERTIES OF A DIELECTRIC LOADED LINEAR ACCELERATOR. J. R. Day. May 13, 1952. Decl. Jan. 21, 1958. 26p.

The work presented is supplementary to previous

memoranda in which the whole aspect of the design of a dielectric-loaded linear accelerator is discussed. Immediate interest lies in the case in which parameters $K_1 + K_3 = K_2 = 0.9$, the central hole having a radius of 0.5 cm, the guide wavelength equal to the wavelength in air, and the dielectric loading having a specific inductive capacity equal to 95. In light of recent measurements, Q has been assigned some, or all, of the values 6,000, 7,000, and 8,000 throughout the calculations. Results are presented in graphical form. (W.D.M.)

10138 CERN-57-21

European Organization for Nuclear Research, Geneva.
THEORY OF LINEAR AND NON-LINEAR PERTURBATIONS OF BETATRON OSCILLATIONS IN ALTERNATING GRADIENT SYNCHROTRONS. A. Schoch. Feb. 1, 1958. 158p.

An approach is presented which facilitates physical interpretation and application of the theory, previously expressed in terms of rather abstract formalisms. The present approach covers linear perturbations and leads to first approximation results. The method was to calculate the change of amplitude and phase of the oscillation brought about by perturbing kicks, making use of the fact that those quantities, which would be constant for the unperturbed motion, vary only slowly if the perturbations are small. This method of "slowly varying amplitude and phase" is adapted to the case of an A.G. synchrotron with quite general perturbations. The procedure partly follows a paper by Beth who treated non-linear coupling resonances in systems with several degrees of freedom long ago. For the sake of simple presentation the theory of one-dimensional oscillations will be given in detail first, and extended to two dimensional oscillations in the last sections. The more satisfactory part of the theory given is restricted to synchrotrons whose parameters are rigidly constant in time. The "dynamic" behavior under conditions of varying parameters (e.g., due to phase oscillations) is known to be appreciably different in certain cases. It is considered to some extent in one of the last sections. The conclusions of the theory regarding requirements on synchrotron parameters and construction tolerances are summarized with a view to the CERN proton synchrotron (CERN PS) in particular. Details necessary for the analysis of a practical synchrotron design are collected in a voluminous appendix. (auth)

10139 CERN-58-8

European Organization for Nuclear Research, Geneva.
MODULATOR CERN SYNCHRO-CYCLOTRON. Frank Krienen. Apr. 23, 1958. 42p.

The design of the tuning fork modulator for the 600 Mev Synchro-Cyclotron is considered. The position of the modulator in the accelerator as a whole required the development of the principle of scaling. These considerations initiated an experimental program which verified and corrected basic design considerations. The mechanics of the tuning fork and of the driving system have been dealt with in extenso. Suitable mechanical and electrical analogues were derived which facilitated the solution of problems. The control and initial operation of the system are described and possible improvements are mentioned. (auth)

10140 MURA-397

Midwestern Universities Research Assn., Madison, Wis.
THEORY OF ACCELERATORS WITH A GENERAL MAGNETIC FIELD. G. Parzen. Apr. 16, 1958. 25p. Contract AT(11-1)-384. $4.80(ph OTS); $2.70(mf OTS).

The particle motion in an accelerator having a general magnetic field is investigated. For a wide class of machines, which includes the A.G. synchrotron, FFAG machines, and the fixed frequency cyclotron, a relatively simple solution of the equations of motion has been found. General expressions for the equilibrium orbit, and for the linear motion and tune are obtained. It is expected that the results should be good within an error of about 15% for presently considered machines. (auth)

10141 UCRL-8050

California. Univ., Berkeley. Radiation Lab.
PARTICLE ACCELERATORS. [PART] I. BIBLIOGRAPHY. [PART] II. LIST OF ACCELERATOR INSTALLATIONS. Gerald A. Behman. Jan. 1, 1958. 153p. Contract W-7405-eng-48. $3.00(OTS).

References to accelerators and accelerator technology in the technical literature from July 1954 through June 1957 are listed in Section I, the bibliography. Most of the references are taken from Nuclear Science Abstracts, Chemical Abstracts, Physics Abstracts, and Electrical Engineering Abstracts. In Section II, accelerator installations throughout the world are listed together with the types of particles accelerated and the energy and other characteristics of the machines. (auth)

10142

CONTINUOUS ENERGY MONITOR FOR THE EXTERNAL BEAM OF A CYCLOTRON. J. A. Northrop and R. H. Stokes (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 29, 287-90(1958) Apr.

A simple scintillation counter system is described which monitors the average energy of particles in the external beam of a cyclotron and simultaneously serves as a current integrator. Energy changes are continuously presented on a chart recorder, thus allowing the machine energy to be held constant to a high degree of accuracy over extended runs. In typical operation using 14-Mev deuterons, the average energy may be held constant to within 0.07%. (auth)

10143

ELECTRON MOTION IN CYCLICAL ACCELERATORS AS A STOCHASTIC PROCESS. A. N. Matveev (M. V. Lomonosov Moscow State Univ.). Soviet Phys. (Doklady) 1, 443-6(1956) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 1556.

10144

ON THE THEORY OF ALTERNATING-GRADIENT FOCUSING. E. L. Burshtein and L. S. Solov'ev. Soviet Phys. (Doklady) 1, 459-62(1956) July-Aug.

Equations are developed which permit the calculation of alternating-gradient focusing in accelerators with slowly varying parameters. (J.S.R.)

10145

OSCILLATION DAMPING IN A CYCLIC ELECTRON ACCELERATOR. Yu. F. Orlov and E. K. Tarasov. Zhur. Eksptl'. i Teoret. Fiz. 34, 651-7(1958) Mar. (In Russian)

Characteristics of damping of radial and phase oscillations are derived with account of variation of the magnetic field along the orbit. In a strong-focusing accelerator, in contrast to a weak focusing accelerator, damping is independent of variation of the gradient $\partial H_z/\partial r$ along the orbit, providing that the field strength H_z is the same in all magnets. (tr-auth)

10146

ON THE UTILIZATION OF MOVING HIGH FREQUENCY POTENTIAL WELLS FOR ACCELERATION OF CHARGED PARTICLES. A. V. Gaponov and M. A. Miller (Gor'kii State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 751-2(1958) Mar. (In Russian)

Radiation Absorption and Scattering

Refer also to abstract 9925.

10147

MEASUREMENT OF THE GAMMA-RAY DOSE NEAR THE INTERFACE BETWEEN TWO MEDIA. Frank Titus (National Bureau of Standards, Washington). Nuclear Sci. and Eng. 3, 609-19(1958) May.

Measurements have been made of the distribution of exposure dose in the neighborhood of a plane boundary separating two media of very different density, steel wool and steel. A point-isotropic Co^{60} source was located in the vicinity of the boundary. Control measurements were performed in a homogeneous medium of steel-wool. In this way the effect on gamma-ray propagation of an abrupt density change was established. The main result was a progressive decrease of exposure dose near the density interface compared with the homogeneous medium situation, as the source-detector distance was increased. There is good agreement between the experimental results and corresponding Monte Carlo calculations. (auth)

10148

EQUIVALENCE FACTORS FOR D_2O. Charles Kelber (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 633-4(1958) May.

The equivalence factors with respect to D_2O for magnesium, aluminum, zirconium, and stainless steel have been calculated for two groups of energies, for neutron energies from 10 Mev to 180 kev and from 180 kev to 1.4 ev. The results are tabulated. (J.S.R.)

10149

ELASTIC SCATTERING OF POLARIZED PHOTONS. D. Brini, E. Fuschini, L. Peli, and P. Veronesi (Istituto di Fisica dell'Università and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 7, 877-90(1958) Mar. 16.

Rayleigh's cross section for a partially polarized photon beam may be expressed as: $d\sigma/d\Omega = d\sigma_0/d\Omega + \xi(d\sigma_1/d\Omega)$, where $d\sigma_0/d\Omega$ is the term resulting from the non-polarized component and $d\sigma_1/d\Omega$ that due to polarization, ξ being the beam polarization degree in respect to the scattering plane. By polarizing a photon beam through a Compton scattering, a given Rayleigh scattering angle θ being fixed, an asymmetry ratio may be defined by: $R = (d\sigma_0/d\Omega + \xi_{||}(d\sigma_1/d\Omega))/(d\sigma_0/d\Omega + \xi_{\perp}(d\sigma_1/d\Omega))$, where the numerator is Rayleigh's cross section for the angle θ in the Compton scattering plane, and the denominator is the same cross section in the plane perpendicular to the Compton scattering one. R has been measured in the polarized photon elastic scattering, by using photons with a $0.64mc^2$ energy scattered on Hg with a $\theta \sim 90°$ angle. The experimental results appear to be in conformity with the theoretical provisions. (auth)

10150

CIRCULAR POLARIZATION OF γ-RAYS EMITTED OPPOSITE TO β-PARTICLES. RESULTS ON ^{46}Sc. A. Lundby, A. P. Patro, and J. P. Stroot (CERN, Geneva). Nuovo cimento (10) 7, 891-4(1958) Mar. 16.

A total amount of 0.5 mg fine Sc_2O_3 powder was spread over a surface of 0.6 cm^2 on a backing of 5 μm Al. The 300 μmc source was mounted in a lucite housing. In order to obtain a reasonable coincidence rate between β and γ rays, the photopeaks from both γ rays had to be accepted. Beta particles with energy above 50 kev were accepted by the coincidence circuit. The results for Sc^{46} are given. (W.D.M.)

10151

SMALL ANGLE SCATTERING FROM COLD-WORKED AND FATIGUED METALS. H. H. Atkinson (Cavendish Lab., Cambridge, Eng.). Phil. Mag. 3, 476-88(1958) May.

Experiments have been made on the small-angle scattering of x rays from polycrystalline copper and single grains of aluminum deformed by cold work or fatigued by pulsating tension. The results confirm in a direct and conclusive way that almost all of the scattering is due to double Bragg reflections. No surface scattering has been observed. Double Bragg reflections have been eliminated in small-angle scattering experiments using cold neutrons: the results indicate the magnitude of the scattering from defects in the volume of the metal. The magnitude of the effect is consistent with scattering from dislocations. There was no observable effect from fatigued metals. Hence there is no direct evidence for the existence of cavities in metals as a result of small angle scattering experiments with either x rays or neutrons. (auth)

10152

THE SMALL ANGLE SCATTERING OF HIGH ENERGY PHOTONS IN URANIUM. J. Moffatt and M. W. Stringfellow (Clarendon Lab., Oxford). Phil. Mag. 3, 540-2 (1958) May.

The differential cross sections have been measured for the scattering of photons of energy 90 Mev in uranium through angles ranging from 1.2 to 4.5 milliradians. The uranium scatterer was 11 g/cm^2 thick, and electrons produced in the scatterer were removed by a magnetic field. (W.D.M.)

10153

RADIAL ATOMIC DISTRIBUTION IN LIQUID HELIUM-4 BY X-RAY SCATTERING. W. L. Gordon, C. H. Shaw, and J. G. Daunt (Ohio State Univ., Columbus). Phys. and Chem. Solids 5, 117-28(1958).

Measurements have been made of the scattering of CuKα X-rays (λ= 1.54 A) from liquid helium at several temperatures between 1.4 and 4.2°K, and from gaseous helium at 4.2°K in the same apparatus. The measurements were made with a low-background proportional counter over a range of scattering angles from 1.5 to 90° at 1.4 and 4.2°K, and for lesser angular ranges at other temperatures. The gas scattering gives a new comparison with theory for the total differential scattering cross-section of the helium atom. The liquid structure factor is found to be unity within the experimental error in the angular range from 65 to 90°, and it seems reasonable to assume that it remains unity for larger angles. On this assumption the radial atomic distribution for the liquid is computed by using the standard Fourier inversion procedure. Estimates are made of the mean separation of nearest neighbors in the liquid, as well as the co-ordination number at the various temperatures. (auth)

10154

ELASTIC SCATTERING OF PROTONS BY Ar^{40}. G. D. Freier, K. F. Famularo, D. M. Zipoy, and J. Leigh (Univ. of Minnesota, Minneapolis). Phys. Rev. 110, 446-7(1958) Apr. 15.

Measurements of the elastic scattering differential cross sections have been made for the p-Ar^{40} interaction. For proton energies between 1.75 and 2.75 Mev and at an angle of 155°, the cross sections are essentially given by the Rutherford equation except for resonances at 1.90 and 2.48 Mev. At these resonance energies, angular distributions for the interaction have been measured. (auth)

10155

COULOMB EXCITATION OF MEDIUM-WEIGHT EVEN-EVEN NUCLEI. P. H. Stelson and F. K. McGowan (Oak Ridge National Lab., Tenn.). Phys. Rev. 110, 489-506(1958) Apr. 15.

The yields of gamma rays resulting from Coulomb excitation have been measured for twenty-nine even-even medium weight nuclei ($92 \leq A \leq 130$). The projectiles used for effecting Coulomb excitation were variable-energy protons (1.5 to 3.3 Mev) and doubly-ionized helium ions (8 to 10 Mev). In the most favorable cases the absolute γ-ray yields are determined to an accuracy of ±4%. The reduced electric quadrupole transition probabilities, B(E2), are determined to an accuracy of ±7% in favorable cases. For the least favorable cases. For the least favorable case the accuracy is ±20%. The observed values for B(E2) are larger than the single particle estimate by factors ranging from 6 to 64. The transition rates in the even-even tin isotopes are larger than the single particle estimate by a factor of 13. A strong correlation is found between the B(E2) and the inverse of the γ-ray energy for transitions with moderately large values for B(E2). The transitions are interpreted in terms of the collective vibrational model. The mass parameters obtained show remarkably little variation and are approximately 10 times the irrotational flow estimate. (auth)

10156

INCOHERENT ELECTRON SCATTERING FROM THE NUCLEONS IN BERYLLIUM AND CARBON AND THE MAGNETIC SIZE OF THE NEUTRON. Hans F. Ehrenberg and Robert Hofstadter (Stanford Univ., Calif.). Phys. Rev. 110, 544-50(1958) Apr. 15.

The electron scattering at high momentum transfer has been measured from the nucleons in Be, in C, and from the free proton. The data yield the cross section of the average nucleon and of the neutron in relation to that of the proton. $\sigma_n/\sigma_p(\theta)$ is found to be 1.16 ± 0.3 at 500 Mev and 135°; it decreases, as expected, for smaller angles and lower energies. If the assumption is made that meson-exchange effects and interactions in the final state are not important, the form factors obtained indicate an apparent root-mean-square radius of the neutron's magnetic-moment distribution of $(0.53 \pm 0.15) \times 10^{-13}$ cm. It is possible that the apparent small size of the neutron in Be and C is due to the neglect of meson-exchange effects and interactions in the final state. The present result is smaller than a neutron size, given by Yearian and Hofstadter, who compared the cross sections of deuteron and proton and found equal sizes for neutron and proton. If one accepts the latter result, the present experiment can be used to yield a measure of the above neglected effects. (auth)

10157

ELECTRON AND PHOTON POLARIZATION IN BREMSSTRAHLUNG AND PAIR PRODUCTION. Haakon Olsen and L. C. Maximon (Fysisk Institutt Norges Tekniske Høgskole, Trondheim, Norway). Phys. Rev. 110, 589-90(1958) Apr. 15.

The cross sections for bremsstrahlung and pair production at high energies for arbitrarily polarized electrons and photons, including Coulomb corrections and screening, have been calculated. (W.D.M.)

10158

SCATTERING OF NUCLEONS FROM NUCLEI AT HIGH ENERGIES. H. McManus and R. M. Thaler (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 110, 590-1(1958) Apr. 15.

The scattering of nucleons from C^{12} has been calculated at energies of 90, 165, and 310 Mev for the elastic scattering cross section and polarization at forward angles, the total cross section, and the total inelastic cross section. Coulomb corrections have been omitted. (W.D.M.)

10159

NEUTRON SPECTRUM FROM p + d REACTION. M. P. Nakada, J. D. Anderson, C. C. Gardner, J. McClure, and C. Wong (Univ. of California, Livermore). Phys. Rev. 110, 594-5(1958) Apr. 15.

Neutrons produced when 8.9-Mev protons bombard deuterium in a gas cell were observed by time-of-flight techniques on the Livermore variable-energy cyclotron. The neutron spectra were observed and converted to an energy distribution in the center-of-mass coördinate system. (W.D.M.)

10160

GAMMA RADIATION FROM THE COLLISIONS OF FAST CHARGED PIONS WITH NUCLEI. A. G. Sitenko (A. M. Gorkii Kharkov State Univ. and Physicotechnical Inst., Academy of Sciences, Ukrainian, SSR). Soviet Phys. (Doklady) 1, 512-16(1956) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 2167.

10161

ON THE IMPROVEMENT OF PERTURBATION THEORY FORMULAS. R. V. Tevikyan (Erevan State Univ.). Soviet Phys. JETP 6, 373-5(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3365.

10162

APPLICATION OF MATRIX POLYNOMIALS TO DETERMINE SCATTERING PHASES. Yu. I. Kulakov (Moscow State Univ.). Soviet Phys. JETP 6, 391-400 (1958) Feb.

A formalism of invariant matrix polynomials $L^{s',s}_{l',l;J}$ is developed for systems of particles of arbitrary spin. A general method for calculating $L^{s',s}_{l',l;J}$ is found, and the polynomials for total spin 0, ½, and 1 are written out explicitly. Equations are given which make the expansion of any invariant operator in polynomials $L^{s',s}_{l',l;J}$ a simple matter. It is shown that the coefficients in such an expansion of the scattering matrix are directly related to the phase-shifts. Formulas are derived for calculating the phase-shifts to any order of perturbation theory. In many specific examples this method simplifies the calculation of phase-shifts. (auth)

10163

ELECTRON CAPTURE CROSS SECTION. V. S. Nikolaev (Moscow State Univ.). Soviet Phys. JETP 6, 417(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3366.

10164

REMARKS OF ELASTIC SCATTERING OF RELATIVISTIC PARTICLES IN MATTER IN THE STEADY STATE.

N. A. Chernikov (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 422-3(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3367.

10165

POLARIZATION EFFECTS IN SCATTERING OF ELECTRONS BY PROTONS. G. V. Frolov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 764-6(1958) Mar. (In Russian)

Calculations were made of the polarization of electrons and recoil protons produced by scattering of polarized electrons on polarized protons. The equations show that in the scattering of polarized electrons on nonpolarized protons the longitudinal component of electron polarization remains constant, and the polarization of recoil protons is completely specified by the longitudinal component of electron polarization. In scattering of nonpolarized electrons on polarized protons the electrons became longitudinally polarized. (R.V.J.)

10166

INELASTIC SCATTERING. Roger G. Newton (Indiana Univ., Bloomington). Ann. Phys. (N. Y.) 4, 29-56(1958) May.

Many channel scattering is studied in a formulation general enough to be applicable, for example, to the scattering of bound systems by one another, such as in nuclear reactions, or to strange particle reactions in which incoming and outgoing particles have different masses. The assumptions made concerning the interaction potentials are relatively weak, no finite nuclear radius being assumed. Effects investigated include threshold phenomena and resonance scattering. Regarding the first, an alternative to the Wigner cusp is found. The Breit-Wigner resonance formula is rederived in a perturbation calculation which assumes neither large level spacings compared to the widths nor poles of the S matrix. It includes among the resonance terms only compound nucleus states, which are defined here uniquely by means of the average particle interactions. (auth)

10167

A STUDY OF NUCLEON FORCES WITH REPULSIVE CORES. IV. CALCULATIONS OF THE SHAPE-DEPENDENT PARAMETERS IN NEUTRON-PROTON SCATTERING. R. L. Preston and M. A. Preston (McMaster Univ., Hamilton, Ont., Can.). Can. J. Phys. 36, 579-84(1958) May.

The magnitudes of the coefficients P and Q in the phase-shift expansion $k \cot \delta = -1/a + \frac{1}{2}r_0k^2 - r_0^3Pk^4 + r_0^5Qk^6 + \ldots$ have been investigated in the case of repulsive-core NP interactions. For square, Gaussian, exponential, and Yukawa shapes, which fit experimental values of the scattering length and the effective range, the shape-dependent parameter P has been computed as a function of r_c in both singlet and triplet states. Also, for square and Yukawa shapes, which fit the scattering length and effective range, Q has been computed in the singlet state. (auth)

10168

CONCERNING DAMPING THEORY. G. F. Zharkov. Nauk Zapiski L'vivs'k 33, 71-7(1955). (Translated from Referat. Zhur. Fiz. No. 4, 1957, abstract No. 8472.)

The problem of what diagrams, in the sense of perturbation theory, are taken into account by the damping theory for the case of meson-nucleon scattering is investigated.

10169

DEUTERON STRIPPING WITH POLARIZED DEUTERONS. G. R. Satchler (Clarendon Lab., Oxford). Nuclear Phys. 6, 543-4(1958) Apr. (2).

In order to estimate the effect of using polarized deuterons on the left-right assymetry in the angular distribution of nucleons from deuteron stripping reactions, the distorted-wave Born approximation has been used. Spin-orbit coupling has been neglected. (W.D.M.)

10170

INELASTIC SCATTERING OF DEUTERONS FROM SPHEROIDAL NUCLEI. J. Sawicki (Inst. for Nuclear Research, Theoretical Physics, Warsaw). Nuclear Phys. 6, 613-17(1958) Apr. (2).

A direct interaction theory of (d, d') reactions is proposed for strongly deformed nuclei of mass number $A \approx 24$. Strong coupling approximation of the unified nuclear model is employed to represent the nucleus and the differential cross-section is calculated in Born approximation for rotational excitations up to the fourth power of the deformation parameter β. The theory is applied to the $Mg^{24}(d, d')Mg^{24}$ (1.37 Mev) reaction. Agreement with experiment is obtained both for the angular distribution (except for $\theta \lesssim 20°$) and for the total cross-section. Further extensions of the model are indicated. (auth)

Radiation Effects

Refer also to abstract 9685.

10171 AECU-3684

Illinois. Univ., Urbana.

IRRADIATION DAMAGE AT LOW TEMPERATURES IN THE NOBLE METALS. Technical Report No. 13. J. S. Koehler, F. Seitz, and R. O. Simmons. May 1958. 28p. Contract AT(11-1)-182. $6.30(ph OTS); $3.00 (mf OTS).

The nature of the damage produced in noble metals by nuclear radiation and the changes which occur during thermal annealing below 60°K are described. Experimental data and interpretation of the damage are summarized. (auth)

10172 CF-58-2-32

Oak Ridge National Lab., Tenn.

ESTIMATE OF THE RATIO OF Ta^{182} TO Co^{60} ACTIVITY EXPECTED IN THE APPR-1 CORE. E. E. Gross. Feb. 10, 1958. 9p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

Of primary interest in a military reactor is the desirability of quick and easy maintenance of as much of the system as possible throughout the lifetime of the power plant. It is therefore desirable that no serious amounts of long-lived activity build up in equipment outside the core. An investigation was made to determine the activity due to small amounts of cobalt and tantalum in the stainless steel core of the APPR-1. The investigation indicates that equal weight percentages of Ta and Co would build up about equal activities in the core after 1.5 years of operation. The use of 347 stainless steel containing a nominal 0.2 wt. % Co would therefore produce a more serious activation problem than is now being experienced with the present 304L core. A desire to reduce the production of long-lived activities would then require specifying a low tantalum as well as a low cobalt content if 347 stainless steel were used for the second APPR-1 core. Fabrication of

a low cobalt 304L core is therefore an attempt to reduce and to simplify the activation problem. (A.C.)

10173 HW-47776(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RADIATION DAMAGE TO GRAPHITE FROM 30 C TO 185 C. R. E. Nightingale and J. F. Fletcher. Sept. 26, 1957. 22p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

Property changes in polycrystalline graphite resulting from reactor irradiations at temperatures up to 185°C and over a range of exposures up to 1135 Mwd/CT have been determined. Changes in stored energy, thermal conductivity, sample length, and C_0 interlayer crystallite spacing are markedly decreased as exposure temperature is increased. Electrical resistivity changes are also less at higher exposure temperatures, but this property change does not depend as strongly on temperature as the others. Isothermal annealing studies of C_0 changes were conducted on a number of irradiated samples. The data were analyzed assuming a large number of processes distributed in activation energy. The results are summarized in activation energy spectra in which the distribution of C_0 damage is given as a function of the activation energy required for annealing. It is found that not only does a higher exposure temperature decrease the total amount of property change, but also the distribution of damage accumulated is considerably different. Results are discussed in terms of the radiation damage model suggested by Hennig and Hove. This model is compatible with the experimental results presented. (auth)

10174 HW-52323
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
NEUTRON IRRADIATION EFFECTS ON THE TENSILE PROPERTIES OF ZIRCALOY-2. R. S. Kemper and D. L. Zimmerman. Aug. 22, 1957. 24p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

The changes produced in the room temperature tensile properties of annealed and 50% cold-worked Zircaloy-2 as a result of irradiation to an estimated integrated thermal neutron flux of 1.4×10^{21} nvt at 40 to 60°C were determined. The results obtained are compared with previous results on Kroll type zirconium. Recovery of radiation damage in initially annealed material was studied in the temperature range 250 to 400°C. This recovery was found to require temperatures equivalent to those for recovery of cold work and the activation energy for the process was found to be consistent with that reported for self-diffusion in zirconium. (auth)

10175
MOLECULAR STRUCTURE AND MOTION IN IRRADIATED POLYETHYLENE. W. P. Slichter and Elaine R. Mandell (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Phys. Chem. 62, 334-40(1958) Mar.

Molecular structure and motion were studied in polyethylene subjected to high-energy irradiation from an atomic pile and from electrons. Measurements involved x-ray diffraction and proton magnetic resonance spectroscopy. Contrary to earlier findings, it is shown that high-energy irradiation inflicts change concurrently in the crystalline and the amorphous regions. Lattice defects are introduced into crystallites. The characteristic separations between chains are altered in both the crystalline and the amorphous regions, and the two regions merge at higher dosages. With increasing dosage, the irradiation causes progressively greater constraint to even small-scale motions. (auth)

10176
THE INFLUENCE OF VACANCIES UPON THE INTERNAL FRICTION OF POLYCRYSTALLINE COPPER. R. S. Barnes, N. H. Hancock, and E. C. H. Silk (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. 3, 519-26(1958) May.

Neutron irradiation, gamma irradiation, and quenching all change the internal friction of pure polycrystalline rods of copper. Only if the rods are initially given an anneal near the melting point for many hours do these three treatments give consistent and similar results, and then the logarithmic decrement is reduced. It is concluded from the results that it is the vacancies introduced by each of the three treatments which pin the dislocation lines by diffusing to them, and that unless the purity of the copper is high their effect can be obscured. (auth)

10177
THE EFFECTS OF NEUTRON IRRADIATION UPON THE INTERNAL FRICTION OF COPPER SINGLE CRYSTALS AT LIQUID NITROGEN TEMPERATURES. R. S. Barnes and N. H.Hancock (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. 3, 527-30(1958) May.

The internal friction of copper single crystals remains unaffected by a short neutron bombardment at −195°C if no warming is allowed before measurement. Successive pulse anneals produce no marked change until 23°C is reached, when the internal friction is greatly reduced. (auth)

10178
THERMOVOLTAIC EFFECT IN GAMMA-IRRADIATED BOROSILICATE GLASS. Bernhard Gross (Instituto Nacional de Technologia, Rio de Janeiro). Phys. Rev. 110, 337-8(1958) Apr. 15.

Borosilicate glass was irradiated with a high dose of gamma rays from a cobalt-60 source. After irradiation the glass was heated while a temperature gradient was maintained between its surfaces. During the heating an external current was observed. The direction of the current in the dielectric corresponded to a transport of negative charge to the electrode with the higher temperature. (auth)

10179
SECONDARY ELECTRON EMISSION UNDER THE ACTION OF 1 TO 4 Mev DEUTERONS. A. I. Akishin (Moscow State Univ.). Zhur. Tekh. Fiz. 28, 776-8(1958) Apr. (In Russian)

The dependence of the γ coefficient on deuterons of 1 to 4 Mev energy was studied. Activated and deactivated foils of CuBe(~2% Be), CuMg(~4% Mg), AlMg(~4% Mg), and thin films of Be-coated nickel were used as targets. The results showed that the γ coefficient for 1 to 4 Mev deuterons changes from 3.5 to 2 during bombardment of the activated alloys CuBe, CuMg, and BeO. Similar results were obtained for AlMg. For the deactivated alloys and metals with the deuteron energy increase in the same range the γ coefficient changes from 1.5 and 2 to 1. (R.V.J.)

Radioactivity

10180
LONG τ_2 LIFETIMES FROM POSITRONIUM ANNIHILATIONS IN LIQUID ARGON AND LIQUID NITROGEN.

D. A. L. Paul (Royal Military Coll., Kingston, Ont., Can.). Can. J. Phys. 36, 640-2(1958) May.

The time spectra of positron decays in liquid argon and liquid nitrogen were investigated using a standard coincidence circuit. Measurements revealed τ_2 components, such as are normally associated with the formation of triplet positronium, in both liquids. The τ_2 components are interesting on account of their long meanlife which is far in excess of values reported for any other liquid except helium. (A.C.)

10181

INVESTIGATION OF NUCLEAR ISOMERISM IN Hf^{180m}. V. S. Gvozdev, L. I. Rusinov, Yu. I. Filimonov, and Yu. L. Khazov (Physico-Technical Inst. of the USSR Academy of Sciences, Leningrad). Nuclear Phys. 6, 561-74(1958) Apr. (2)

The coefficient of internal conversion of the 57.6 kev transition in the L-shell of Hf^{180m} was measured and found to be $\alpha_L = 0.33 \pm 0.10$. The γ transition is shown to be of the E1 type. A 501.2 kev γ transition has been detected; measurements of the internal conversion coefficient yield $\alpha_K = 0.035 \pm 0.014$. The 501.2 kev γ transition is of the E3 type. The level with an excitation energy 1 142.9 kev was found to possess a spin 9 and negative parity. The experimental lifetimes for the 57.6 kev and 501.2 kev γ transitions exceed those predicted by the single particle model by respectively 10^{16} and 10^9 times. This large discrepancy is due to the high forbiddenness of the γ transitions with respect to the quantum number K. Internal conversion coefficients have also been measured for γ transitions of 93.3 kev, 216 kev, 332.4 kev, and 443.6 kev energy. The transitions were all found to be of the E2 type. The cross section for production of Hf^{180m} in the (n,γ) reaction has been determined and found to equal $\sigma = 0.18 \pm 0.07$ barns. (auth)

10182

NUCLEAR ALIGNMENT AND THE BETA TRANSITION IN COBALT-58. P. Dagley, M. A. Grace, J. S. Hill, and C. V. Sowter (Clarendon Lab., Oxford). Phil. Mag. 3, 489-96(1958) May.

A single crystal of nickel fluosilicate has been used for the low-temperature alignment of cobalt-58. Angular distribution measurements of the 805-kev γ radiation are consistent with the β transition being pure Gamow-Teller, the Fermi admixture being given by $C_F^2 |M_F|^2 / \{C_F^2 |M_F|^2 + C_{GT}^2 |M_{GT}|^2\} = 0.003 \pm 0.005$. (auth)

10183

THE HALF-LIFE OF IODINE-131. L. Burkinshaw (Univ. of Cambridge, Eng.). Phys. in Med. Biol. 2, 255-7(1958) Jan.

A measurement of the half-life of the principal mode of decay of I^{131} gave the value 8.054 ± 0.010 days. Combining this figure with other published values, the most probable half-life and its standard error are found to be 8.0545 ± 0.0063 days.

10184

K CAPTURE–POSITRON RATIOS FOR FIRST-FORBIDDEN TRANSITIONS: Sb^{122}, Rb^{84}, I^{128}, AND As^{74}. M. L. Perlman, Joan P. Welker, and M. Wolfsberg (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 110, 381-92(1958) Apr. 15.

The theory for the relative probabilities of K-electron capture and of positron emission is reinvestigated in the cases of allowed and first-forbidden transitions. Effects of screening and of finite nuclear size are discussed and calculated. Careful comparison is made between theory and available experimental results for allowed and "unique" first-forbidden transitions; details and results of a new measurement for the transition $Sb^{122} \rightarrow Sn^{122}$ ($\Delta J = 2$, yes) are presented. Other types of first-forbidden transitions are analyzed in terms of the relative contributions of the various matrix elements which appear in the interaction combinations S, T, P and V, A; and the experimental results for the $\Delta J = 0$, yes transitions in As^{74}, Rb^{84}, and I^{128} are discussed. Simple formulas are presented for the evaluation of the coefficients of the several matrix elements. (auth)

10185

NUCLEAR STRUCTURE OF Zr^{90}. N. H. Lazar, G. D. O'Kelley (Oak Ridge National Lab., Tenn.) and J. H. Hamilton, L. M. Langer, and W. G. Smith (Indiana Univ., Bloomington). Phys. Rev. 110, 513-19(1958) Apr. 15.

Beta- and gamma-ray spectroscopy, utilizing both single and coincident NaI(Tl) crystals and a magnetic spectrometer, has been used to study the radiations from Nb^{90}. The positron spectrum was resolved into components of 1.505 and 0.655 Mev; the internal-conversion electron spectrum was obtained, from which gamma-ray transitions of 0.132, 0.141, 0.372, 1.13, and 2.34 Mev were determined. The internal-conversion electron spectrum characteristic of the 1.76-Mev monopole transition in Zr^{90} was also seen. The scintillation gamma-ray spectrum was resolved into components of 2.32, 2.19, 2.0, 1.85, 1.60, 1.48, 1.27, 1.13, 1.1, 0.89, 0.372, (0.43), 0.142, 0.133 Mev. Based on these data, a level scheme for Zr^{90} was formulated with excited states at 1.76(0+), 2.19(2+), 2.32(5–), 3.08(4+), 3.45(6+), 3.59(8+), 4.44, 5.05, and 5.45 Mev, and may be qualitatively understood in terms of an independent-particle model. (auth)

10186

ADDITIONAL DATA ON THE RADIOACTIVE DECAY OF Ho^{166} (27 hr), Nd^{147}, AND Sm^{153}. J. M. Cork, M. K. Brice, R. G. Helmer, and R. M. Woods, Jr. (Univ. of Michigan, Ann Arbor). Phys. Rev. 110, 526-8(1958) Apr. 15.

By using chemically pure Ho^{165} and enriched isotopes of Nd^{146} and Sm^{152}, high-activity samples of Ho^{166}, Nd^{147}, and Sm^{153} were made by neutron capture. Studies of the strong sources by both magnetic and scintillation spectrometers showed the existence of some gamma rays not previously reported, yielded more exact energy values for the low-energy gamma rays, and made possible better resolution of the components of the beta spectra. In Ho^{166}, gamma rays occur at 80.25, 970, 1377, 1540, and 1620 kev, and the maximum beta energies are 1839, 1756, 869, 412, and 230 kev. Nd^{147} yields gamma rays at 91.3, 120.6, 198.2, 277, 321, 400, 441, 533, and 688 kev, with beta components at 812, 380, and 230 kev. In Sm^{153} gamma rays are found at 69.8, 103.5, 173.6, and 540 kev and beta components at 813, 710, and 640 kev. A level scheme in agreement with the observed data is presented for each nucleus. (auth)

10187

NATURAL AND FISSION-PRODUCED GAMMA-RAY EMITTING RADIOACTIVITY IN SOIL. P. F. Gustafson, L. D. Marinelli, and S. S. Brar (Argonne National Lab., Lemont, Ill.). Science 127, 1240-2(1958) May 23.

The gamma-ray spectrum of topsoil collected in 1950 is compared with that of topsoil collected in the same area in 1957. The gamma-ray spectrum emitted by present-day surface soil reveals the presence of radioactive fission products from fall-out. Individual fission product activities found in soil samples are summarized. Counting methods are described. (C.H.)

10188

DECAY SCHEME OF Ba^{140}. A. N. Silant'ev (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 569-73(1958) Mar. (In Russian)

The γ-ray spectrum of Ba^{140} was measured with a scintillation γ spectrometer. The spectrum was treated by the method proposed by Maeder, Müller, and Wintersteiger. The relative intensities of γ rays with energies of 30, 160, 305, 430, and 537 kev were equal to 0.7, 0.18, 0.12, 0.18, and 1.0, respectively. Measurements of γ—γ and β—γ coincidences were performed. On the basis of the results obtained in the present paper and in previous investigations a decay scheme for Ba^{140} is proposed. (tr-auth)

10189

DEPENDENCE OF THE α-DECAY RATE OF ENERGY OF ROTATIONAL LEVELS. L. L. Goldin. Zhur. Eksptl'. i Teoret. Fiz. 34, 643-5(1958) Mar. (In Russian)

In α decay of spin $\frac{1}{2}$ nuclei to rotational levels with $K = \frac{1}{2}$ it is possible to separate the dependence of the α decay probability on energy from the dependence on the angular momentum carried off by the α particle. An analysis carried out for Pu^{239} shows that the energy dependence of the α-decay rate for levels belonging to the same rotational band obeys the same formula as does the rate of α decay to the ground levels of even-even nuclei. (tr-auth)

10190

CALORIMETRIC DETERMINATION OF HALF LIFE OF Ra^{226}. G. V. Gorshkov, Z. G. Gritchenko, and N. S. Shimanskaya (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 756-7(1958) Mar. (In Russian)

Calorimetric measurements were made of three equilibrium radium preparations (Ra I, Ra II, and Ra III) with total α impurities not exceeding 0.2 wt. %. Based on the data for the α and β spectra of the radium series, the value ϵ was equal to 25.335 Mev (± 0.3%). Using the above value the calculations of the Ra^{226} half life showed $T = 1577 \pm 9$ years. Consequently, the specific activity, connected to T by a simple relation $Z = 1.847 \times 10^{21}/T$, is $Z = 3.71 \pm 0.02 \times 10^{10}$ fission/sec g. (R.V.J.)

10191

ELECTRON–NEUTRINO CORRELATION IN β^- DECAY OF Na^{24}. N. A. Burgov and Yu. V. Terekhov. Zhur. Eksptl'. i Teoret. Fiz. 34, 769(1958) Mar. (In Russian)

The maximum cross section for resonance scattering at 120° between the recorded γ quanta was equal to $(3.1 \pm 0.4) \times 10^{-25}$ cm^2. The life time of the level was $\sim 2 \times 10^{-13}$ sec. The mean time between the two collisions of recoil nuclei in the source was $\sim 10^{-11}$ sec. The recoil nuclei are considered free, and the calculations confirm the results obtained in previous work. (R.V.J.)

Rare Earths and Rare-earth Compounds

Refer also to abstracts 10039 and 10186.

10192 AEC-tr-3249

THE PHASE DIAGRAM OF CERIUM. A. I. Likhter, Yu. N. Ryabinin, and L. F. Vereshchagin. Translated from Zhur. Eksptl'. i Teoret. Fiz. 33, 610-13(1957). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3403.

Shielding

10193 AERE-HP/GEN-6

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

CALCULATION OF U, Pb, Fe AND Al SHIELDING FOR IRRADIATED NATURAL URANIUM. E. M. Flew and B. T. James. Dec. 5, 1955. Decl. Mar. 31, 1958. 6p.

A list of all gamma-emitting fission products with significant yield after decay for one day was compiled, and the products grouped according to gamma-energy ranges. Dosage transmission factors were calculated and graphs plotted for fractions of gamma dosage transmitted against thickness of aluminum, iron, lead, and uranium for cooling times of 1, 16, and 63 days assuming an irradiation time of 3 weeks. (J.R.D.)

10194 AERE-T/M-49

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME CALCULATIONS ON THE SHIELDS NECESSARY FOR DIFFERENT SIZES OF EFFLUENT TANKS. J. H. Tait and J. Price. June 6, 1951. Decl. Apr. 18, 1958. 14p.

Calculations were carried out to determine the most economical way of shielding the effluent in a tank of given size. In the analysis the cylindrical shape was approximated by a spherical one, taking the radius of the latter as equal to half the length of the cylinder. The dose at the outer surface of the effluent tank is calculated, and the effects of multiple scattering in the effluent and shield are assessed. (L.T.W.)

10195 NARF-58-20T

Convair, Fort Worth, Tex.

RADIATION PROTECTION CHARACTERISTICS OF PARTIAL SHIELDS FOR NUCLEAR AIRCRAFT SERVICING. P. L. Marjon. Apr. 21, 1958. 45p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-200).

An experimental investigation was made to determine the limiting radiation field parameters in the use of the partial shield concept in ground support applications for nuclear aircraft. When used in the presence of multiple sources of radioactivity, such as an activated airplane, the partial shield can reduce the radiation exposure of a mechanic to that amount which originates in his immediate work area, by providing shielding on all sides except for an opening through which work is performed. Another feature of the partial shield concept is that it utilizes the higher total radiation dose which the hands are permitted to receive over the allowed total body tolerance. A reactor fuel element was used as a source to investigate the radiation protection characteristics of two elementary versions of the partial shield concept. One is the open-front type, which is simply a shield box with a work opening. The other is the body-shielded, open-front type. This type is similar to the open front version except that it has an additional body shield inside the box. Field conditions are defined in which direct maintenance would be possible on a nuclear airplane by use of these types of partial shields. (auth)

Spectroscopy

10196

THE ARC SPECTRUM OF IODINE AND THE QUADRUPOLE MOMENT OF I^{127} Kiyoshi Murakawa (Univ.

of Tokyo). J. Phys. Soc. Japan 13, 484-92(1958) May.

The analysis of the arc spectrum of iodine has been continued, and the identification of the term sequence $(^3P_2)nf$ has been fairly well completed, and some other levels newly detected. From the hyperfine structure of $(^3P_2)7p\,^4D_{1/2}$ the quadrupole moment without shielding correction was found to be $Q'(I^{127}) = -0.63$ barn, whereas the value that was deduced from $(^3P)6s\,^4P_{1/2}$ previously was $Q'(I^{127}) = -0.71$ barn. The mean of these two values is $Q'(I^{127}) = -0.67 \pm 0.04$ barn. This is in agreement with the value $Q'(I^{127}) = -0.66$ barn that is deduced from hfs of the ground term $5p^5\,^2P_{3/2}$ whose measurement is given in the literature. Assuming the shielding correction $\Delta = -0.07$, the true quadrupole moment $Q(I^{127}) = -0.62$ barn has been obtained. (auth)

10197

X-RAY-INDUCED COLOR CENTERS IN MgO. R. W. Soshea, A. J. Dekker, and J. P. Sturtz (Univ. of Minnesota, Minneapolis). Phys. and Chem. Solids 5, 23-33(1958).

An analysis is presented of the optical absorption spectrum induced in MgO crystals by heat treatment in oxygen; the analysis gives Gaussian bands near quantum energies of 5.7, 4.8, and 4.3 ev for the region investigated, which extends to 6 ev. A similar analysis of the absorption spectrum induced by X-irradiation at room temperature gives Gaussian bands near 5.7, 4.8, 4.3, and 2.3 ev, plus absorption in the region below 4 ev. Results concerning the growth and thermal decay of the optical absorption induced by X-irradiation at room temperature and at 600°C are presented. A study has also been made of the spectrum induced by X-irradiation of crystals previously colored by heat treatment in oxygen. The results are discussed in terms of a model which assumes the presence of ions of variable valence. (auth)

10198

HYPERFINE STRUCTURE OF PARAMAGNETIC RESONANT LINES IN SUPERCOOLED SOLUTIONS OF $^{51}V^{++}$, $^{53}Cr^{+++}$ AND $^{55}Mn^{++}$. N. S. Garif'ianov (Physicotechnical Inst., Kazan Affiliate, Academy of Sciences, USSR). Soviet Phys. (Doklady) 1, 463-5(1956) July-Aug.

The results of investigations of the hyperfine structure of paramagnetic resonance lines in supercooled solutions of $(V^{51})^{2+}$, $(Cr^{53})^{3+}$, and $(Mn^{55})^{2+}$ with frequencies of 520, 150, 91, and 58 Mc at 90°K are reported. Ethyl alcohol and glycerine were used as solvents, and an anthracene line was used to calibrate the magnetic field. (J.S.R.)

Theoretical Physics

10199 NP-6679 (Rpt: UNCLASSIFIED)

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

PHENOMENOLOGICAL THEORY OF THE S-MATRIX AND T, C AND P INVARIANCE. [PART] I. Report No. 7/VII. J. Werle. Jan. 1958. 21p.

General expressions for the transition matrix are given for reactions between four particles of arbitrary spins. Restrictions imposed by T, C, or P invariance requirements are expressed in terms of certain equations between some phenomenological scalar coefficients which occur in the general expression for the transition matrix. For any given type of reaction one can find in this way definite physical relations which have the advantage of being free of any special assumptions and approximations. (auth)

10200 NYO-7697

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.

BASIC NOTIONS OF RELATIVISTIC HYDROMAGNETICS. Paul Reichel. Apr. 15, 1958. 38p. Contract AT(30-1)-1480. $6.30(ph OTS); $3.00(mf OTS).

This report is an elaboration and extension by the author of notes of lectures given by Professor K. O. Friedrichs at New York University in November 1954. The basic notions of relativistic hydromagnetics are presented, and the characteristic speeds of propagation of small disturbances are computed. (auth)

10201

CLASSICAL THEORY OF BOSON WAVE FIELDS. E. P. Gross (Brandeis Univ., Waltham, Mass.). Ann. Phys. (N. Y.) 4, 57-74(1958) May.

The subject of discussion is the Hamiltonian for a system of bosons interacting by two body forces, as expressed in the formalism of second quantization. In this paper, we examine properties of the classical wave field governed by the Hamiltonian. For a general potential there is always an exact solution representing a uniform density. Exact solutions are exhibited, which represent disturbances of a definite velocity and of arbitrary amplitude. For small amplitudes the disturbances obey Bogolyubov's dispersion relation. Corresponding solutions are found for disturbances when the system moves as a whole. For suitably attractive potentials we find a class of exact solutions, degenerate in energy, with spatially periodic density. These solutions have a lower energy than the uniform type. Small amplitude excitations are investigated for the periodic case. They are phonons for long wavelengths, but show a band character at shorter wavelengths. A theory of the motion of foreign atoms in the boson fluid is formulated. (auth)

10202

QUANTUM ELECTRODYNAMICS AT SMALL DISTANCES. S. D. Drell (Stanford Univ., Stanford, Calif.). Ann. Phys. (N. Y.) 4, 75-86(1958) May.

The validity of quantum electrodynamics (Q.E.D.) at small distances is discussed in the light of present experimental information. Large angle pair production in hydrogen, together with elastic electron-proton scattering, is analyzed as a means of obtaining further information on the small distance behavior of Q.E.D. (auth)

10203

A NOTE ON STATISTICAL TENSORS IN QUANTUM MECHANICS. L. C. Biedenharn (Rice Inst., Houston, Texas). Ann. Phys. (N. Y.) 4, 104-13(1958) May.

The statistical tensors introduced by Fano are discussed as an operator form of the density matrix. The conditions for a statistical tensor to represent a pure state are derived; a general representation of a pure state in terms of 2j Poincaré vectors is exhibited, and a physical interpretation given. The coupling of statistical tensors is discussed briefly. (auth)

10204

A NEW FORM OF NON-LINEAR GENERALIZATION OF THE THEORY OF PARTICLES WITH SPIN. Gérard Petiau. Compt. rend. 246, 2581-3(1958) May 5. (In French)

New types of non-linear wave equations represented by systems of equations with partial derivatives of the first order are introduced. The equations permit solutions of multiply periodic plane waves. For the most simple case the elliptical functions of Jacobi are used and for the general case the Abel functions are used. (J.S.R.)

10205

NEW TYPE OF RELATIVISTICALLY-INVARIANT LINEAR LOCAL FIELD EQUATIONS. R. S. Ingarden (Wroclaw Univ., Academy of Sciences, Poland.) Doklady Akad. Nauk S.S.S.R. 108, 56-9(1956). (Translated from Referat. Zhur. Fiz. No. 4, 1957, abstract No. 8488.)

Linear differential field equations with variable coefficients, depending on the coördinates of the source of this field are considered. The equations should satisfy the principles of relativistic invariance, superposition, and localizability. In the second-order class of equations the author determines the conditions that determine uniquely the desired equation for an instantaneous point source. Solutions of the equation are found, and the solution of the equation with a point source which existed all the time prior to a certain instant of observation g_1 and moved inertially is given.

10206

A VARIATIONAL APPROACH TO THE NUCLEAR MANY-BODY PROBLEM. V. J. Emery (Cavendish Lab., Cambridge). Nuclear Phys. 6, 585-95(1958) Apr. (2).

Jastrow's variation method is applied to the nuclear many-body problem. It is found that it is necessary to restrict the variation of the trial function in order to obtain reasonable results from the approximation used. Calculations of the properties of nuclear matter are used to investigate the effects of two possible restrictions. The physical justification of the restrictions is discussed and a method of generalizing the trial wave function is given. (auth)

10207

A TENTATIVE GENERAL SCHEME FOR WEAK INTERACTIONS. B. D'Espagnat and J. Prentki (CERN, Geneva). Nuclear Phys. 6, 596-612(1958) Apr. (2).

A generalized isobaric spin formalism (M space formalism) that automatically conserves charge and can be extended to leptonic interactions is applied to the whole set of presently known decays. It is shown that within the framework of this theory there exists at least one choice of weak interactions that does not contradict any known experimental data on hyperon, K mesons, pion and muon decays, or on ordinary β decays inasmuch as these are compatible with a V−A coupling. In relation to possible modifications of this choice one or two decay modes are mentioned, which might up to now have escaped detection. (auth)

10208

THE HYPOTHESIS OF CONSERVATION OF COMBINED PARITY ONLY IN STRONG, ELECTROMAGNETIC AND WEAK INTERACTIONS. V. G. Solov'ev (Lab. of Theoretical Physics, Joint Inst. of Nuclear Research, Dubna, USSR). Nuclear Phys. 6, 618-24 (1958) Apr. (2).

The hypothesis is considered that only combined parity IC is conserved in strong, electromagnetic, and weak interactions. It is demonstrated that the hypothesis is not inconsistent with available experimental data. However, more precise polarization experiments are required for a proof that the hypothesis is correct. It is shown that gage invariance in quantum electrodynamics and isobaric invariance in pseudoscalar meson theory lead to invariance of renormalizable interaction Lagrangians under space reflection I. Renormalizable and isobarically-invariant Lagrangians for the interaction between K mesons and baryons are obtained which are invariant under the operation IC but not under the operation I. (auth)

10209

MASS SELECTION RULES IN THE BILOCAL THEORY. II. E. Minardi (Societa Nazionale Cogne, Aosta and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 7, 898-900(1958) Mar. 16.

It is shown that the strangeness quantum number S of the elementary particles follows in a very simple way from the bilocal theory of the elementary particles previously developed and that the majority of the unobserved particles predicted are excluded because strangeness is not conserved in their production in π + N reactions. (W.D.M.)

10210

THEORY OF FINITE NUCLEI. K. A. Brueckner (Univ. of Pennsylvania, Philadelphia), J. L. Gammel (Los Alamos Scientific Lab., N. Mex.), and H. Weitzner (Harvard Univ.). Phys. Rev. 110, 431-45(1958) Apr. 15.

A theory of finite nuclei is formulated, based on the reaction-matrix theory of the nuclear many-body system. The reaction matrix appropriate to the finite nucleus is in the exact theory determined by the solution of coupled Hartree-Fock and reaction-matrix self consistency problems. This formal procedure is extremely difficult to carry out; the finite-nucleus reaction matrix has instead been approximated by the reaction matrix appropriate to the local density, which is a nonlocal coordinate space operator $(r|K|r')$. It is shown that this approximation is equivalent to the assumption that a finite nucleus has the same short-range correlation structure as nuclear matter. (auth)

10211

TIME-REVERSAL INVARIANCE AND BETA-GAMMA ANGULAR CORRELATION. II. M. Morita and R. S. Morita (Columbia Univ., New York). Phys. Rev. 110, 461-5(1958) Apr. 15.

The angular correlation function between beta and gamma rays from oriented nuclei is given for use in testing the invariance property of the beta interactions under time reversal. The formulas are derived in the cases where the beta decay is an allowed or first forbidden transition and the gamma ray has a mixture of arbitrary multipolarities. A general form for the $\beta-\gamma_1-\gamma_2$ angular correlation in triple cascade transitions of unoriented nuclei is also shown. It does not give clear-cut information on the invariance property of beta interactions under time reversal. The correlation functions where gamma rays are replaced by alpha particles are discussed in the above two cases. The beta-alpha directional correlation from oriented nuclei may be useful in testing the invariance property of beta interactions under time reversal. (auth)

10212

SIMILARITY BETWEEN SHELL MODEL AND DEFORMED NUCLEUS WAVE FUNCTIONS. Martin G. Redlich (Massachusetts Inst. of Tech., Cambridge and Univ. of Colorado, Boulder). Phys. Rev. 110, 468-76 (1958) Apr. 15.

A body coördinate system x'y'z' is defined in which the density of nuclear matter is assumed axially symmetric about the z' axis, the angular momentum $j_{z'}$ of each of the A nucleons in the nucleus about this axis being quantized. The wave function of a nucleon is φ_k, with $j_{z'}\varphi_k = k\varphi_k$. The system x'y'z' is rotated relative to a system xyz fixed in space in such a way that the nucleus is in a state of total angular momentum J, with z component M, while the z' component remains $K = k_1 + \cdots + k_A$. The nuclear wave function is Ψ_{MK}^{J}. The φ_k are so defined that the Ψ_{MK}^{J} are similar to wave functions obtained for shell-theoretical calculations. In

order to represent at least 13 low states with A = 18 and 19, three φ_k are needed. These φ_k resemble χ_k, the wave functions of particles in a slightly deformed harmonic-oscillator well. Calculated ft values and magnetic moments are also similar to those for shell theory. (auth)

10213

A DISPERSION RELATION FOR FERMIONS. V. Fainberg and E. Fradkin (P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 1, 455-8(1956) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 1706.

10214

ON SOME ELECTROMAGNETIC EFFECTS INVOLVING STRONGLY INTERACTING PARTICLES. L. M. Afrikian and G. M. Garibyan (Physics Inst., Academy of Sciences, Armenian, SSR). Soviet Phys. JETP 6, 331-4 (1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3433.

10215

ENERGY DISTRIBUTIONS IN TWO-PARTICLE DECAYS. G. I. Kopylov (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 335-44(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3434.

10216

ANOMALOUS EQUATIONS FOR SPIN 1/2 PARTICLES. Ivan Ulegla (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 369-72(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3435.

10217

ON THE CONSERVATION OF COMBINED PARITY. V. G. Solov'ev (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 419-20(1958) Feb.

The following hypothesis is proposed and examined: In the construction of the Lagrangians of the strong, electromagnetic, and weak interactions of elementary particles, it is necessary to require invariance with respect to IC and T, i.e., the conservation of only the combined parity. Only the strong and electromagnetic interactions are considered. (J.S.R.)

10218

CONCERNING UNIVERSAL INTERACTION OF PARTICLES WITH HALF-INTEGRAL SPIN. G. Nikovadze. Sr. Nauch. Rabot Stud. Tbilissk. No. 7, 8-11(1955). (Translated from Referat. Zhur. Fiz. No. 4, 1957, abstract No. 8484.)

On the basis of the so-called universal interaction for all elementary particles with half-integral spin, a suggestion is made that the particles contain a special "g-charge." By ascribing to N, P, μ^+, e^+, and ν particles and to the corresponding anti-particles g-charges of opposite signs, and by using a hypothesis concerning the conservation of this charge, it is possible to forbid processes not experimentally observed and to allow known processes. It is noted that introducing the g-charge eliminates the Majorana version of the neutrino theory.

10219

PHOTON MASS IN QUANTUM ELECTRODYNAMICS. D. G. Dirzhnits (Physics Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 30, No. 4, 796-7 (1956). (Translated from Referat. Zhur. Fiz. No. 4, 1957, abstract No. 8441.)

An expression for the mass of a photon, obtained by using the smearing function F (p, k, p -k, Λ), introduced into the interaction $e_2 \int F(p, k, p-k, \Lambda)\, \bar{\psi}(p)\hat{A}(k)\, \psi(p-k)d^4pd^4Kf$ plus charge conjugate is investgated. Asymptotic espressions are used for the Green's function and this makes it possible to obtain for the square of the mass of the photon at large values of Λ, where Λ is the cutoff momentum, the following expression $P_{\mu\nu}(0) = (e_1^2/\pi_1)\, \Lambda^2\delta_{\mu\nu}\int_0^\infty |f(x)|^2 dx + 0(\ln \Lambda^2)$. The most widely known type of smearing F (p, 0, p, Λ)$f(p^2/\Lambda^2)$ is considered. The same deductions can be made also in the general case. The appearance of the square of the modulus f in this case is due to the requirement that the Lagrangian be Hermitian. Thus, the problem of the elimination of the mass of the photon (for arbitrary sufficiently large Λ) by choosing a suitable smearing function F has no solution. As to the possibility of using the spinor function F, an investigation in this case is difficult owing to the absence of any developed theory. In this connection it is noted that introducing the well known Pauli-Villars form factor is effective because it is connected with the smearing, not of the interaction, but of the polarization operator directly. Attention is further called to the substantial dependence of $P_{\mu\nu}(0)$ on the longitudinal portion of the Green's function. An exception is the widely known case, when the smearing $f(x) = 1$, $x < 1$ and $f(x) = 0$, $x > 1$ is used. Here the mass of the photon is exactly due to the value obtained in the lower approximation of perturbation theory.

10220

GENERALIZED METHOD FOR CALCULATING DAMPING IN RELATIVISTIC QUANTUM FIELD THEORY. V. I. Grigor'yev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 30, No. 5, 873-80(1956). Translated from Referat. Zhur. Fiz No. 4, 1957, abstract No. 8471.)

The general transition matrix is represented in the form of a sum of an infinite number of particle matrices, each of which describes the process of absorption and emission of a fixed number of fermions and bosons. For the partial transition matrices the author constructs a system of "chain equations," equivalent to the Tomonago-Schwinger equation for the general transition matrix. The solution, obtained by successive substitution, leads for the partial matrices of transition to results that generalize the results of the damping theory.

10221

REMARKS ON THE PAULI THEOREM CONCERNING THE CONNECTION BETWEEN SPIN AND STATISTICS. V. L. Pokrovskiy and Yu. B. Rumer (Western Siberia Branch, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 31, No. 1, 337-8(1956). (Translated from Referat. Zhur. Fiz. No. 4, 1957, abstract No. 8407.)

The proof given by Pauli (Pauli, "Relativistic Theory of Elementary Particles," IIL, 1947, Supplement) for a theorem concerning the connection between the spin and the statistics is based on a consideration of irreducible representations of the tensor and spinor quantities in transformations of a Lorentz group with a determinant equal to unity. A proof is given of the above theorem in which it is shown that it is enough to restrict oneself to a consideration of the tran formation of the quantities with general inversion (inversion of all four coördinate axes).

Uranium and Uranium Compounds

Refer also to abstracts 10049 and 10152.

10222 CRL-51(Rev.)
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
URANIUM DIOXIDE—A PROMISING NUCLEAR FUEL. A Metallurgy Seminar Presented at the University of Toronto, January 24, 1958 and at McMaster University, March 6, 1958. O. J. C. Runnalls. Jan. 1958. 35p. (AECL-553(Rev.)). $1.00(AECL).

Canada's need for power is dealt with briefly. Experience with U metal in the NRX Reactor in relatively cold water and experiments with hot water which indicate that U metal is unsatisfactory for water-cooled power reactors are discussed. Information is presented to support the contention that Zr alloy clad UO_2 will meet the required specifications of corrosion resistance, irradiation stability, and economic fabrication costs. Photographs illustrating variations in corrosion behavior, radiation effects, and fabrication techniques for U and UO_2 are given. (M.H.R.)

10223 LAMS-2200
Los Alamos Scientific Lab., N. Mex.
U^{239} FISSION CROSS SECTION. Joseph J. Devaney. Feb. 1958. 5p. Contract W-7405-eng-36. $1.80 (ph OTS); $1.80(mf OTS).

A crude estimate was made of the U^{239} fission cross section. The estimate and its basis are reported. (J.S.R.)

10224 NYO-7929
Aeroprojects, Inc., West Chester, Penna.
FEASIBILITY STUDY ON ULTRASONIC DISPERSION OF URANIUM DIOXIDE IN MOLTEN METALS. Interim Report. H. L. Bromberg and W. B. Tarpley. May 1958. 21p. Contract AT(30-1)-1836. $3.30(ph OTS); $2.40(mf OTS).

To aid in design studies for fast power breeders and thermal reactors, brief laboratory investigation was made of the effects of ultrasonics on a UO_2—NaK slurry. Vibratory energy at 20 kc was initially introduced at power levels of 5, 50, and 75 watts for determination of ultrasonic transmission characteristics and subsequently at 500 watts for erosion effects. No evidence of pitting of exposed component surfaces was noted. In particle size analysis, the ultrasonically treated UO_2—NaK slurry showed a weight mean UO_2 particle size of 5.8 microns compared to 8.4 microns for an untreated sample. From this and similar experiments, it is concluded that ultrasonic energy can be successfully applied to such systems for the purpose of reducing particle size of suspended solids and/or eliminating floc formation. (auth)

10225 ORNL-2452
Oak Ridge National Lab., Tenn.
RADIATION EXCURSIONS AT THE ORNL CRITICAL EXPERIMENTS LABORATORY. I. MAY 26, 1954. II. FEBRUARY 1, 1956. J. T. Thomas and D. Callihan. May 27, 1958. 34p. Contract W-7405-eng-26. $1.00 (OTS).

Two prompt critical power excursions have occurred in enriched UO_2F_2 solutions used in critical experiments at Oak Ridge National Laboratory. The first resulted from a mechanical failure in the equipment, and the second was due to a redistribution of the solution caused by the insertion of a safety device into a near critical volume. Although the safety mechanism operated normally in both instances, the order of 10^{17} fissions occurred, corresponding to an energy release of about 1 kwh. No significant property damage occurred and personnel exposures were limited to a few hundred mr. Experiments were resumed in a few days. On the basis a partial reconstruction of the first event, a semiquantitative analysis was made; a similar treatment of the second was not attempted. (auth)

10226 RDB(S)/TM-3245
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE PHYSICAL METALLURGY OF URANIUM: 3RD REVIEW—A MICROGRAPHIC STUDY OF INCLUSIONS IN URANIUM. M. D. Jepson, W. A. Pollock, and G. Slattery. [1955]. 13p.

The metallographic examination of a large number of samples of uranium made at Springfields has revealed the existence of at least six distinct types of inclusion. While the composition of the inclusions has not been established with certainty, it is believed that they include uranium dioxide, uranium monocarbide, uranium monocarbide in association with uranium oxide or nitride, intermetallic compounds of uranium with iron, silicon, or aluminum, and calcium fluoride slag. (auth)

10227 UK/C/6/125
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE THERMAL FISSION CROSS-SECTION OF U-233. [Paper presented at] Sixth UK/Canada Technical Conference, Chalk River, Ontario, October 21-22, 1957. C. B. Bigham, P. J. Campion, G. C. Hanna, and P. R. Tunnicliffe. Sept. 1957. 4p.

Presented at the International Conference on Neutron Interactions with Nucleus at Columbia University, New York, Sept. 9-13, 1957.

The measurements described in UK/C-6/124 have been supplemented by a determination of the fission cross section of U^{233} in terms of the activation cross section of gold. The same apparatus and procedures were used except that the gold foils instead of a fissile sample were placed on one side of the back-to-back ion chamber. It was found that the α-particle efficiency was increased over the nominal 2π geometry by low-angle back-scattering and that the geometrical efficiencies were equal. Four independent determinations of the U^{233} cross sections were in good agreement, the mean result being $\sigma_f = 524 \pm 4$ b. (A.C.)

10228
TREATMENT OF URANIUM ORES. II. I. Beranek and F. Holub. Jaderna Energie 4, 66-73(1958). (In Czech.)

A survey is made of different methods for uranium separation using ion exchange resins and solvent extraction. (tr-auth)

10229
THE FISSION OF URANIUM AND PROTACTINIUM AT HIGH EXCITATION ENERGIES. V. P. Shamov (Radium Inst., Academy of Sciences, USSR). Soviet Phys. JETP 6, 268-73(1958) Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3402.

10230
FISSION OF U^{238}. M. N. Nikolaev, V. I. Golubev, and I. I. Bondarenko. Zhur. Eksptl'. i Teoret. Fiz. 34, 752-4 (1958) Mar. (In Russian)

The fission of U^{238} by fission neutrons in large masses of uranium was investigated in relation to the perform-

ance of many types of reactors. Descriptions are given of the measurements made in 1954 of the total number of U^{238} fissions taking place in the infinite uranium slug per one fission neutron. (R.V.J.)

PATENTS

Chemistry

10231

PRODUCTION OF FLUOROCARBONS. N. F. Sarsfield (to U. S. Atomic Energy Commission). U. S. Patent 2,473,911. June 21, 1949.

This patent pertains to a process for recovering fluorocarbons from a liquid mixture of hydrocarbons with partially and completely fluorinated products thereof. It consists of contacting the mixture in the cold with a liquid which is a solvent for the hydrocarbons and which is a nonsolvent for the fluorocarbons, extracting the hydrocarbons, separating the fluorocarbon-containing layer from the solvent-containing layer, and submitting the fluorocarbon layer to fractional distillation, to isolate the desired fluorocarbon fraction. Suitable solvents which may be used in the process include the lower aliphatic alcohols, and the lower aliphatic ketones.

10232

PRODUCTION OF FLUORINE-CONTAINING HYDROCARBON. N. F. Sarsfield (to U. S. Atomic Energy Commission). U. S. Patent 2,478,666. Aug. 9, 1949.

This patent relates to improvements in the production of fluorine-containing hydrocarbon derivatives. The process for increasing the degree of fluorination of a fluorochlorohydrocarbon comprises subjecting a highly fluorinated fluorochlorohydrocarbon to the action of a dehydrochlorinating agent, and treating the resulting unsaturated body with fluorine, cobalt trifluoride, or silver difluoride. A number of reagents are known as dehydrochlorinating agents, including, for example, the caustic alkalies, either in an anhydrous condition or dissolved in water or a lower aliphatic alcohol.

10233

PROCESS FOR THE PRODUCTION OF AMMONIUM URANIUM FLUORIDE. A. S. Ellis and R. B. Mooney (to U. S. Atomic Energy Commission). U. S. Patent 2,650,153. Aug. 25, 1953.

This patent relates to the preparation of ammonium uranium fluoride. The process comprises adding a water soluble fluoride to an aqueous solution of a uranous compound containing an ammonium salt, and isolating the resulting precipitate.

10234

PREPARATION OF BERYLLIUM FLUORIDE. G. Barr (to U. S. Atomic Energy Commission). U. S. Patent 2,653,856. Sept. 29, 1953.

This patent describes a simple and efficient method for the production of solid beryllium fluoride from the double salt $BeF_2 \cdot 2NH_4F$, without the evolution of appreciable quantities of ammonium fluoride. The double salt $BeF_2 \cdot 2NH_4F$ is thoroughly mixed with beryllium oxide in the ratio of 1.1 mol to 1 mol and then heated to a temperature of at least 450°C until ammonia ceases to be evolved. The resultant product is solid beryllium fluoride free of any appreciable amount of oxyfluoride.

10235

PROCESS FOR THE PRODUCTION OF URANIUM TETRAFLUORIDE. A. S. Leah and R. B. Mooney (to U. S. Atomic Energy Commission). Patent 2,654,654. Oct 6, 1953.

This patent relates to the manufacture of uranium tetrafluoride from ammonium uranium fluoride, NH_4UF_5. Uranium tetrafluoride is prepared by heating the ammonium uranium fluoride to a temperature at which dissociation occurs with liberation of ammonium fluoride. Preferably the process is carried out under reduced pressure, or in a current of an inert gas.

10236

ELECTROLYTIC PRODUCTION OF URANIUM TETRAFLUORIDE. E. Lofthouse (to U. S. Atomic Energy Commission). U. S. Patent 2,687,995. Aug. 31, 1954.

This patent relates to electrolytic methods for the production of uranium tetrafluoride. According to the present invention a process for the production of uranium tetrafluoride comprises submitting to electrolysis an aqueous solution of uranyl fluoride containing free hydrofluoric acid. Advantageously the aqueous solution of uranyl fluoride is obtained by dissolving uranium hexafluoride in water. On electrolysis, the uranyl ions are reduced to uranous ions at the cathode and immediately combine with the fluoride ions in solution to form the insoluble uranium tetrafluoride which is precipitated.

10237

PROCESS FOR PRODUCING URANIUM TETRAFLUORIDE. B. G. Harvey (to U. S. Atomic Energy Commission). U. S. Patent 2,689,165. Sept. 14, 1954.

This patent relates to improvements in the method for producing uranium tetrafluoride by treating an aqueous solution of a uranyl salt at an elevated temperature with a reducing agent effective in acid solution in the presence of hydrofluoric acid. Uranium tetrafluoride produced this way frequently contains impurities in the raw material serving as the source of uranium. Uranium tetrafluoride much less contaminated with impurities than when prepared by the above method can be prepared from materials containing such impurities by first adding a small proportion of reducing agent so as to cause a small fraction, for example 1 to 5% of the uranium tetrafluoride to be precipitated, rejecting such precipitate, and then precipitating and recovering the remainder of the uranium tetrafluoride.

10238

PROCESS FOR THE RECOVERY OF URANIUM. G. O. Morris (to U. S. Atomic Energy Commission). U. S. Patent 2,711,361. June 21, 1955.

This patent relates to a process for the recovery of uranium from impure uranium tetrafluoride. The process consists essentially of the steps of dissolving the impure uranium tetrafluoride in excess dilute sulfuric acid in the presence of excess hydrogen peroxide, precipitating ammonium uranate from the solution so formed by adding an excess of aqueous ammonia, dissolving the precipitate in sulfuric acid and adding hydrogen peroxide to precipitate uranium peroxide.

10239

PROCESS FOR TREATING VOLATILE METAL FLUORIDES. A. J. Rudge and A. J. Lowe (to U. S. Atomic Energy Commission). U. S. Patent 2,808,312. Oct. 1, 1957.

This patent relates to the purification of uranium hexafluoride, made by reacting the metal or its tetrafluoride with fluorine, from the frequently contained traces of hydrofluoric acid. According to the present process, UF_6 containing as an impurity a small amount of hydrofluoric acid, is treated to remove such impurity

by contact with an anhydrous alkali metal fluoride such as sodium fluoride. In this way a non-volatile complex containing hydrofluoric acid and the alkali metal fluoride is formed, and the volatile UF_6 may then be removed by distillation.

10240

METHOD OF SEPARATING PLUTONIUM. H. S. Brown and O. F. Hill (to U. S. Atomic Energy Commission). U. S. Patent 2,822,239. Feb. 4, 1958.

Plutonium hexafluoride is a satisfactory fluorinating agent and may be reacted with various materials capable of forming fluorides, such as copper, iron, zinc, etc., with consequent formation of the metal fluoride and reduction of the plutonium to the form of a lower fluoride. In accordance with the present invention, it has been found that the reactivity of plutonium hexafluoride with other fluoridizable materials is so great that the process may be used as a method of separating plutonium from mixtures containing plutonium hexafluoride and other vaporized fluorides even though the plutonium is present in but minute quantities. This process may be carried out by treating a mixture of fluoride vapors comprising plutonium hexafluoride and fluoride of uranium to selectively reduce the plutonium hexafluoride and convert it to a less volatile fluoride, and then recovering said less volatile fluoride from the vapor by condensation.

10241

DECONTAMINATION OF URANIUM. H. M. Feder and N. R. Chellew (to U. S. Atomic Energy Commission). U. S. Patent 2,822,260. Feb. 4, 1958.

This patent deals with the separation of rare earth and other fission products from neutron bombarded uranium. This is accomplished by melting the uranium in contact with either thorium oxide, magnesium oxide, aluminum oxide, beryllium oxide, or uranium dioxide. The melting is preferably carried out at from 1150° to 1400°C in an inert atmosphere, such as argon or helium. During this treatment a scale of uranium dioxide forms on the uranium which contains most of the fission products.

10242

RECOVERY OF THORIUM AND URANIUM VALUES FROM AQUEOUS SOLUTIONS. G. D. Calkins (to U. S. Atomic Energy Commission). U. S. Patent 2,823,976. Feb. 18, 1958.

This patent deals with the separation and recovery of uranium from monazite sand. After initial treatment of the sand with sodium hydroxide, a precipitate is obtained which contains the uranium, thorium, rare earths and some phosphorus. This precipitate is then dissolved in nitric acid. The bulk of the rare earths are removed from this solution by adding an excess of alkali carbonate, causing precipitation of the rare earths together with part of the thorium present. The solution still contains a considerable amount of thorium, some rare earths, and practically all of the uranium originally present. Thorium and rare earth values are readily precipitated from such solution, and the uranium values thus isolated, by the addition of an excess hydrogen peroxide. The pH value of the solution is preferably adjusted to at least 9 prior to the addition of the peroxide.

10243

METHOD OF DISSOLVING URANIUM METAL. L. A. Slotin (to U. S. Atomic Energy Commission). U. S. Patent 2,823,977. Feb. 18, 1958.

This patent relates to an economical means of dissolving metallic uranium. It has been found that the addition of a small amount of perchloric acid to the concentrated nitric acid in which the uranium is being dissolved greatly shortens the time necessary for dissolution of the metal. Thus the use of about 1 or 2 percent of perchloric acid based on the weight of the nitric acid used, reduces the time of dissolution of uranium by a factor of about 100.

10244

PRECIPITATION METHOD OF SEPARATING PLUTONIUM FROM CONTAMINATING ELEMENTS. J. B. Sutton (to U. S. Atomic Energy Commission). U. S. Patent 2,823,978. Feb. 18, 1958.

This patent relates to an improved method for the decontamination of plutonium. The process consists broadly in an improvement in a method for recovering plutonium from radioactive uranium fission products in aqueous solutions by decontamination steps including by-product carrier precipitation comprising the step of introducing a preformed aqueous slurry of a hydroxide of a metal of group IV B into an aqueous acidic solution which contains the plutonium in the hexavalent state, radioactive uranium fission products contaminant and a by-product carrier precipitate and separating the metal hydroxide and by-product precipitate from the solution. The process of this invention is especially useful in the separation of plutonium from radioactive zirconium and columbium fission products.

10245

SEPARATION OF SCANDIUM FROM AQUEOUS SOLUTIONS. D. F. Peppard and E. S. Nachtman (to U. S. Atomic Energy Commission). U. S. Patent 2,824,783. Feb. 25, 1958.

This patent relates to a process for the separation of scandium from yttrium, thorium, and trivalent rare earths and with their separation from each other. It has been found that scandium and yttrium can be separated from trivalent rare earths in acidic solution, for example, a solution 6 M in HCl, by contacting with tributyl phosphate, whereupon the scandium is preferentially extracted into the organic phase, leaving the yttrium and trivalent rare earths in the aqueous phase.

10246

GRAB MECHANISMS. K. H. Dent (to U. S. Atomic Energy Commission). U. S. Patent 2,825,599. Mar. 4, 1948.

This patent relates to a device for lifting objects having specially designed arms that fit into aligned slots within concentric sleeves of the grab mechanism. Upon the application of an electric current the sleeves are rotated relative to one another to the aforesaid aligned position, allowing the entry or removal of the arms of the lifted object. The sleeves are spring biased to an unaligned position, thus locking the arms within the grab mechanism when the current is off. This arrangement provides a device that will remotely secure, life, and release an object, with the assurance that the object will remain securely locked during the lifting operation.

Engineering

10247

ELECTROMAGNETIC PUMP. O. O. Pulley (to U. S. Atomic Energy Commission). U. S. Patent 2,686,474. Aug. 17, 1954.

This patent relates to electromagnetic pumps for electricity-conducting fluids and, in particular, describes several modifications for a linear conduction

type electromagnetic interaction pump. The invention resides in passing the return conductor for the current traversing the fluid in the duct back through the gap in the iron circuit of the pump. Both the maximum allowable pressure and the efficiency of a linear conduction electromagnetic pump are increased by incorporation of the present invention.

Mineralogy, Metallurgy, and Ceramics

10248

APPARATUS FOR THE PURIFICATION OF CALCIUM. R. LeG. Burnett (to U. S. Atomic Energy Commission). U. S. Patent 2,650,085. Aug. 25, 1953.

The present patent claims and describes an apparatus adapted to carry out a new process for the purification of calcium containing an alkali metal as impurity. The process consists of distilling the impure calcium in the presence of an inert gas and at a reduced pressure, condensing substantially pure calcium on a condensing surface of iron or a ferrous alloy and condensing the alkali metal on a separate surface, the two condensing surfaces being maintained at suitable temperatures by separate cooling means.

10249

DISTILLATION OF CALCIUM. J. Barton (to U. S. Atomic Energy Commission). U. S. Patent 2,684,898. July 27, 1954.

This invention relates to an improvement in the process for the purification of calcium or magnesium containing an alkali metal as impurity, which comprises distilling a batch of the mixture in two stages, the first stage distillation being carried out in the presence of an inert gas at an absolute pressure substantially greater than the vapor pressure of calcium or magnesium at the temperature of distillation, but less than the vapor pressure at that temperature of the alkali metal impurity so that only the alkali metal is vaporized and condensed on a condensing surface. A second stage distillation is then carried out in the absence of an inert gas so that substantially only the calcium or magnesium distills under its own vapor pressure only and condenses in solid form on a lower condensing surface.

10250

METHOD OF PREPARING SINTERED ZIRCONIUM METAL FROM ITS HYDRIDES. R. P. Angier (to U. S. Atomic Energy Commission). U. S. Patent 2,823,116. Feb. 11, 1958.

This invention relates to the preparation of metal shapes from zirconium hydride by powder metallurgical techniques. The zirconium hydride powder which is to be used for this purpose can be prepared by rendering massive pieces of crystal bar zirconium friable by heat treatment in purified hydrogen. This can then be ground into powder and powder can be handled in the air without danger of it igniting. It may then be compacted in the normal manner by being placed in a die. The compact is sintered under vacuum conditions preferably at a temperature ranging from 1200 to 1300°C and for periods of one to three hours.

10251

SOLDERING OF ALUMINUM BASE METALS. G. F. Erickson (to U. S. Atomic Energy Commission). U. S. Patent 2,824,365. Feb. 25, 1958.

This patent deals with the soldering of aluminum to metals of different types, such as copper, brass, and iron. This is accomplished by heating the aluminum metal to be soldered to slightly above 30°C, rubbing a small amount of metallic gallium into the part of the surface to be soldered, whereby an aluminum–gallium alloy forms on the surface, and then heating the aluminum piece to the melting point of lead–tin soft solder, applying lead–tin soft solder to this alloyed surface, and combining the aluminum with the other metal to which it is to be soldered.

10252

APPARATUS FOR MELTING AND POURING METAL. F. A. Harris (to U. S. Atomic Energy Commission). U. S. Patent 2,824,732. Feb. 25, 1958.

This patent relates to a crucible for melting and pouring a metal under controlled atmospheric conditions. The crucible has a frangible plug in the bottom and a retaining device to prevent the entrance of the broken portions of the plug into the mold without interfering with the flow of the melt. After the charge has been melted, a knockout rod is lowered through the charge and forced against the frangible plug sufficiently to break off the closure disk along a previously scored line. The disk drops onto a retaining grid large enough to permit the flow of metal around the disk and into the mold below. This arrangement eliminates the entry of broken portions of the plug into the mold, thereby eliminating a common cause of imperfect castings.

10253

METHOD FOR THE PREPARATION OF STABLE ACTINIDE METAL OXIDE-CONTAINING SLURRIES AND OF THE OXIDES THEREFOR. R. S. Hansen and R. E. Minturn (to U. S. Atomic Energy Commission). U. S. Patent 2,824,784. Feb. 25, 1958.

This patent deals with a method of preparing actinide metal oxides of a very fine particle size and of forming stable suspensions therefrom. The process consists of dissolving the nitrate of the actinide element in a combustible organic solvent; converting the solution obtained into a spray, and igniting the spray whereby an oxide powder is obtained. The oxide powder is then slurried in an aqueous solution of a substance which is adsorbable by said oxides, dispersed in a colloid mill whereby a suspension is obtained, and electrodialyzed until a low specific conductance is reached.

10254

METAL PRODUCTION AND CASTING. T. T. Magel (to U. S. Atomic Energy Commission). U. S. Patent 2,825,105. Mar. 4, 1958.

This patent covers a method and apparatus for collecting the molten metal produced by high temperature metal salt reduction. It consists essentially of subjecting the reaction vessel to centrifugal force in order to force the liberated molten metal into a coherent molten mass, and allowing it to solidify there. The apparatus is particularly suitable for use with small quantities of rare metals.

10255

ALLOY FOR USE IN NUCLEAR FISSION. F. A. Spedding and H. A. Wilhelm (to U. S. Atomic Energy Commission). U. S. Patent 2,826,495. Mar. 11, 1958.

This patent relates to an alloy composition capable of functioning as a solid homogeneous reactor fuel. The alloy consists of a beryllium moderator, together with at least 0.7% of U^{235}, and up to 50% thorium to give increased workability to the alloy.

10256

VAPOR SHIELD FOR INDUCTION FURNACE. S. L. Reese and S. A. Samoriga (to U. S. Atomic Energy Commission). U. S. Patent 2,826,624. Mar. 11, 1958.

This patent relates to a water-cooled vapor shield for an induction furnace that will condense metallic vapors arising from the crucible and thus prevent their condensation on or near the induction coils, thereby eliminating possible corrosion or shorting out of the coils. This is accomplished by placing, about the top, of the crucible a disk, apron, and cooling jacket that separates the area of the coils from the interior of the crucible and provides a cooled surface upon which the vapors may condense.

Physics

10257

THERMAL CONDUCTIVITY ANALYSIS OF GASES. W. J. Clark (to U. S. Atomic Energy Commission). U. S. Patent 2,472,645. June 7, 1949.

This patent describes apparatus for the quantitative analysis of a gaseous mixture at subatmospheric pressure by measurement of its thermal conductivity. A heated wire forms one leg of a bridge circuit, while the gas under test is passed about the wire at a constant rate. The bridge unbalance will be a measure of the change in composition of the gas, if compensation is made for the effect due to gas pressure change. The apparatus provides a voltage varying with fluctuations of pressure in series with the indicating device placed across the bridge, to counterbalance the voltage change caused by fluctuations in the pressure of the gaseous mixture.

10258

TIMING OF SHOCK WAVES. J. L. Tuck (to U. S. Atomic Energy Commission). U. S. Patent 2,703,366. Mar. 1, 1955.

This patent relates to means for ascertaining the instant of arrival of a shock wave in an explosive charge and apparatus utilizing this means to coordinate the timing of two operations involving a short interval of time. A pair of spaced electrodes are inserted along the line of an explosive train with a voltage applied there-across which is insufficient to cause discharge. When it is desired to initiate operation of a device at the time the explosive shock wave reaches a particular point on the explosive line, the device having an inherent time delay, the electrodes are located ahead of the point such that the ionization of the area between the electrodes caused by the traveling explosive shock wave sends a signal to initiate operation of the device to cause it to operate at the proper time. The operated device may be photographic equipment consisting of an x-ray illuminating tube.

10259

QUARTZ FIBER ELECTROSCOPES. R. P. Henderson (to U. S. Atomic Energy Commission). U. S. Patent 2,742,577. Apr. 17, 1956.

This patent pertains to quartz fiber electroscopes of small size for use by personnel to monitor nuclear radiation. The invention resides in a novel way of charging the electroscope whereby the charging of the electroscope whereby the charging of the electroscope is carried out without obtaining contact with the fiber system or its support and the electroscope can therefore be constructed without a protective cap to prevent wrongful discharge. The electroscope is charged by placing a voltage between an electrode located in close proximity to the element to be charged and the electroscope metallic case.

10260

PULSE AMPLITUDE ANALYSERS. I. A. D. Lewis (to U. S. Atomic Energy Commission). U. S. Patent 2,745,985. May 15, 1956.

This patent pertains to an electrical pulse amplitude analyzer, capable of accepting input pulses having a separation between adjacent pulses in the order of one microsecond while providing a large number of channels of classification. In its broad aspect the described pulse amplitude analyzer utilizes a storage cathode ray tube and control circuitry whereby the amplitude of the analyzed pulses controls both the intensity and vertical deflection of the beam to charge particular spots in horizontal sectors of the tube face as the beam is moved horizontally across the tube face. As soon as the beam has swept the length of the tube the information stored therein is read out by scanning individually each horizontal sector corresponding to a certain range of pulse amplitudes and applying the output signal from each scan to separate indicating means.

10261

WAVE DELAYING STRUCTURE FOR RECTANGULAR WAVE-GUIDES. R. B. Robertson-Shersby-Harvie and J. Dain (to U. S. Atomic Energy Commission). U. S. Patent 2,770,781. Nov. 13, 1956.

This patent relates to wave-guides and in particular describes wave delaying structure located within a wave-guide. The disclosed wave-guide has an elongated flat metal sheet arranged in a central plane of the guide and formed with a series of transverse inductive slots such that each face presents an inductive impedance to the guide. The sheet is thickened in the area between slots to increase the self capacity of the slots. Experimental results indicate that in a wave-guide loaded in accordance with the invention the guided wavelength changes more slowly as the air wavelength is changed than the guided wavelength does in wave-guides loaded by means of corrugations.

10262

DIELECTRIC-LOADED WAVE-GUIDES. R. B. Robertson-Shersby-Harvie and L. B. Mullett (to U. S. Atomic Energy Commission). U. S. Patent 2,790,149. Apr. 23, 1957.

This patent presents a particular arrangement for dielectric loading of a wave-guide carrying an electromagnetic wave in the E or TM mode of at least the second order, to reduce the power dissipated as the result of conduction loss in the wave-guide walls. To achieve this desirable result, the effective dielectric constants in the radial direction of adjacent coaxial tubular regions bounded approximately by successive nodal surfaces within the electromagnetic field are of two different values alternating in the radial direction, the innermost and outermost regions being of the lower value, and the dielectric constants between nodes are uniform.

10263

NEGATIVE GATE GENERATOR. C. S. Jones and T. E. Eaton (to U. S. Atomic Energy Commission). U. S. Patent 2,822,472. Feb. 4, 1958.

This patent relates to pulse generating circuits and more particularly to rectangular pulse generators. The pulse generator of the present invention incorporates thyratrons as switching elements to discharge a first capacitor through a load resistor to initiate and provide the body of a pulse, and subsequently discharge a second capacitor to impress the potential of its charge, with opposite potential polarity across the load resistor to

terminate the pulse. Accurate rectangular pulses in the millimicrosecond range are produced across a low impedance by this generator.

10264

PULSE DURATION LENGTHENER. W. R. Aiken (to U. S. Atomic Energy Commission). U. S. Patent 2,822,473. Feb. 4, 1958.

This patent pertains to pulse modifying apparatus and, more particularly, describes a device to provide a rise time and time base expander for signal pulses having a very short duration. The basic element of the device is a vacuum tube comprising a charged particle beam, grid control means, an accelerating electrode, a drift tube, and a collector electrode. As the short duration input pulse modulates the particle beam through the grid control means, the voltage between the drift tube and accelerating electrode is caused to vary, whereby the output signal from the collector is a pulse having longer rise time, expanded duration and proportionate characteristics of the original pulse. The invention is particularly useful where subsequent pulse circuitry does not have the frequency bandwidth to handle the short duration pulse without distorting it.

10265

RADIATION COUNTER. W. W. Goldsworthy (to U. S. Atomic Energy Commission). U. S. Patent 2,822,479. Feb. 4, 1958.

This patent relates to a radiation counter, and more particularly, to a scintillation counter having high uniform sensitivity over a wide area and capable of measuring alpha, beta, and gamma contamination over wide energy ranges, for use in quickly checking the contamination of personnel. Several photomultiplier tubes are disposed in parallel relationship within a light tight housing behind a wall of scintillation material. Mounted within the housing with the photomultipliers are circuit means for producing an audible sound for each pulse detected, and a range selector developing a voltage proportional to the repetition rate of the detected pulses and automatically altering its time constant when the voltage reaches a predetermined value, so that manual range adjustment of associated metering means is not required.

10266

INJECTION-MOLDING APPARATUS. G. M. Lobell (to U. S. Atomic Energy Commission). U. S. Patent 2,822,578. Feb. 11, 1958.

This patent is drawn to an injection molding apparatus for producing a tube closed at one end wherein the normally unsupported end of the core located in the cavity of the mold is provided with a means to support that end during the injection of the molten material to fill the space between the core and cavity wall, which supporting means is automatically removed from operation during the forming of the closed end of the tube. This support means is a plug extending through the end of the core into a recess in the bottom of the cavity where the closed end of the tube is to be formed. The plug is spring pressed into said recess and is forced out of the recess by a slidable bushing at the top of the cavity which is moved against the force of the spring by the molten material when it fills the uppermost open end portion of the cavity, thereby permitting the closed end of the tube to be formed.

10267

DETECTION OF COATING FAILURES IN A NEUTRONIC REACTOR. A. H. Snell and S. K. Allison (to U. S. Atomic Energy Commission). U. S. Patent 2,823,179. Feb. 11, 1958.

This patent relates to water-cooled reactor systems and discloses a means to detect leaks in the jackets of jacketed fuel elements comprising a neutron detector located in the cooling water discharge pipe, the pipe being provided with an enlarged portion for housing the detector so that the latter is completely surrounded by the water in its passage through the pipe, said enlarged portion and detector being shielded from the reactor for the purpose of detecting only those delayed neutrons emitted in the cooling water and due to the latter picking up fission fragments from the defective fuel elements.

10268

METHOD OF LOCATING GROUNDS. K. G. Macleish (to U. S. Atomic Energy Commission). U. S. Patent 2,823,350. Feb. 11, 1958.

This patent presents a method for locating a ground in a d-c circuit having a number of parallel branches connected across a d-c source or generator. The complete method comprises the steps of locating the ground with reference to the midpoint of the parallel branches by connecting a potentiometer across the terminals of the circuit and connecting the slider of the potentiometer to ground through a current indicating instrument, adjusting the slider to right or left of the midpoint so as to cause the instrument to indicate zero, connecting the terminal of the network which is farthest from the ground as thus indicated by the potentiometer to ground through a condenser, impressing a ripple voltage on the circuit, and then measuring the ripple voltage at the midpoint of each parallel branch to find the branch in which is the lowest value of ripple voltage, and then measuring the distribution of the ripple voltage along this branch to determine the point at which the ripple voltage drops off to zero or substantially zero due to the existence of a ground. The invention has particular application where a circuit ground is present which will disappear if the normal circuit voltage is removed.

10269

REACTOR UNLOADING. M. C. Leverett (to U. S. Atomic Energy Commission). U. S. Patent 2,824,056. Feb. 18, 1958.

This patent is related to gas cooled reactors wherein the fuel elements are disposed in vertical channels extending through the reactor core, the cooling gas passing through the channels from the bottom to the top of the core. The invention is a means for unloading the fuel elements from the core and comprises dump values in the form of flat cars mounted on wheels at the bottom of the core structure which support vertical stacks of fuel elements. When the flat cars are moved, either manually or automatically, for normal unloading purposes, or due to a rapid rise in the reproduction ratio within the core, the fuel elements are permitted to fall by gravity out of the core structure thereby reducing the reproduction ratio or stopping the reaction as desired.

10270

METHOD AND MEANS FOR RADIATION DOSIMETRY. J. W. Shulte and J. F. Suttle (to U. S. Atomic Energy Commission). U. S. Patent 2,824,234. Feb. 18, 1958.

This patent relates to a method and device for determining quantities of gamma radiation and x radiation by exposing to such radiation a mixture of a purified halogenated hydrocarbon chosen from the class consisting of chloroform, bromoform, tetrachloroethane and 1,1,2-trichloroethane, and a minor quantity of a sensitizer chosen from the class consisting of oxygen, benzoyl peroxide, sodium peroxide, and nitrobenzene, the proportion of the sensitizer being at least about 10^{-5} moles per cubic centimeter of halogenated hydrocarbon, the total amount of sensitizer depending upon the range of

radiation to be measured, and chemically measuring the amount of decomposition generated by the irradiation of the sensitized halogenated hydrocarbon.

10271

IONIZATION CHAMBER. W. C. Redman and F. R. Shonka (to U. S. Atomic Energy Commission). U. S. Patent 2,824,252. Feb. 18, 1958.

This patent describes a novel ionization chamber which is well suited to measuring the radioactivity of the various portions of a wire as the wire is moved at a uniform speed, in order to produce the neutron flux traverse pattern of a reactor in which the wire was previously exposed to neutron radiation. The ionization chamber of the present invention is characterized by the construction wherein the wire is passed through a tubular, straight electrode and radiation shielding material is disposed along the wire except at an intermediate, narrow area where the second electrode of the chamber is located.

10272

SCINTILLATOR COMPOSITION FOR COUNTERS AND METHOD OF MAKING. W. L. Buck and R. K. Swank (to U. S. Atomic Energy Commission). U. S. Patent 2,824,841. Feb. 25, 1958.

This patent deals with a new composition for plastic scintillators and the method of making them. This is accomplished by mixing a solvent, selected from the group consisting of styrene, methylstyrene where the methyl group is attached to the ring, and p-vinylbiphenyl with p-terphenyl as a primary fluor. Marked improvement in the fluorescent properties of this scintillator composition is obtained by incorporating as a second fluor, a small amount of a highly conjugated hydrocarbon having four phenyl groups such as quaterphenyl or 1,1,4,4-tetraphenyl-1,3-butadiene. It is advisable to use very pure monomers in this composition, and to carry out its preparation in the absence of air.

10273

CALUTRON. M. D. Kamen (to U. S. Atomic Energy Commission). U. S. Patent, 2,824,967. Feb. 25, 1958.

This patent describes an improved ion source for a calutron which is designed to eliminate the necessity of opening the evacuated calutron tank to permit entrance into the tank to place a further charge in the ion source. The improved ion source comprises a charge reservoir positioned exterior to the calutron tank and connected to an ionizing device located within the tank by a channeled member. A section of the tank wall supports the ion source structure and is removable to allow withdrawal of the composite assembly. Heat is applied to the charge reservoir to vaporize the charge and force the charge to the ionizing device, and heat is also furnished along the connecting channel to prevent condensation of the vapor, a valve structure at the exit from the charge reservoir controls the amount of charge received by the ionizing device.

10274

RADIATION DETECTOR SYSTEM. J. C. Gundlach and G. G. Kelley (to U. S. Atomic Energy Commission). U. S. Patent 2,824,973. Feb. 25, 1958.

This patent relates to radiation detection devices and presents a unique detection system especially desirable for portable type instruments using a Geiger-Mueller counting tube. The disclosed system eliminates the need for a high voltage battery, thereby reducing the size and weight of the instrument, by arranging a one-shot multivibrator to recharge a capacitance applying operating potential to the Geiger-Mueller tube each time a nuclear particle is detected. When detection occurs, the multivibrator further delivers a pulse to an appropriate indicator doing away with the necessity for the pulse amplifier conventionally intermediate between the detector and indicator in pulse detection systems.

10275

POWER GENERATING NEUTRONIC REACTOR SYSTEM. H. C. Vernon (to U. S. Atomic Energy Commission). U. S. Patent 2,825,688. Mar. 4, 1958.

This patent relates to reactor systems of the type wherein the cooling medium is a liquid which is converted by the heat of the reaction to steam which is conveyed directly to a prime mover such as a steam turbine driving a generator, after which it is condensed and returned to the coolant circuit. In this design, the reactor core is disposed within a tank for containing either a slurry type fuel or an aggregation of solid fuel elements such as elongated rods submerged in a liquid moderator such as heavy water. The top of the tank is provided with a nozzle which extends into an expansion chamber connected with the upper end of the tank, the coolant being maintained in the expansion chamber at a level above the nozzle and the steam being formed in the expansion chamber.

10276

NEUTRONIC REACTOR AND FUEL ELEMENT THEREFOR. L. Szilard and G. J. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,825,689. Mar. 4, 1958.

This patent relates to a reactor design of the type which employs solid fuel elements disposed in channels within the moderator through which channels and around the fuel elements is conveyed a coolant fluid. The coolant channels are comprised of aluminum tubes extending through a solid moderator such as graphite and the fuel elements are comprised of an elongated solid body of natural uranium jacketed in an aluminum jacket with the ends thereof closed by aluminum caps of substantially greater thickness than the jacket walls and in good thermal contact with the fuel material to facilitate the conduction of heat from the central portion of said ends to the coolant surrounding the fuel element to prevent overheating of said central portion.

10277

GAS PHOTOTUBE CIRCUIT. J. H. Richardson (to U. S. Atomic Energy Commission). U. S. Patent 2,825,818. Mar. 4, 1958.

This patent pertains to electronic circuits for measuring the intensity of light and is especially concerned with measurement between preset light thresholds. Such a circuit has application in connection with devices for reading-out information stored on punch cards or tapes where the cards and tapes are translucent. By the novel arrangement of this invention the sensitivity of a gas phototube is maintained at a low value when the light intensity is below a first threshold level. If the light level rises above the first threshold level, the tube is rendered highly sensitive and an output signal will vary in proportion to the light intensity change. When the light level decreases below a second threshold level, the gas phototube is automatically rendered highly insensitive. Each of these threshold points is adjustable.

10278

PLASMA GENERATOR. J. S. Foster, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,826,708. Mar. 11, 1958.

This patent describes apparatus for producing an electrically neutral ionized gas discharge, termed a

plasma, substantially free from contamination with neutral gas particles. The plasma generator of the present invention comprises a plasma chamber wherein gas introduced into the chamber is ionized by a radiofrequency source. A magnetic field is used to focus the plasma in line with an exit. This magnetic field cooperates with a differential pressure created across the exit to draw a uniform and uncontaminated plasma from the plasma chamber.

10279

COOLED NEUTRONIC REACTOR. C. R. Binner and C. B. Wilkie (to U. S. Atomic Energy Commission). U. S. Patent 2,827,429. Mar. 18, 1958.

This patent relates to a design for a reactor of the type in which a fluid coolant is flowed through the active portion of the reactor. This design provides for the cooling of the shielding material as well as the reactor core by the same fluid coolant. The core structure is a solid moderator having coolant channels in which are disposed the fuel elements in rod or slug form. The coolant fluid enters the chamber in the shield, in which the core is located, passes over the inner surface of said chamber, enters the core structure at the center, passes through the coolant channels over the fuel elements and out through exhaust ducts.

10280

STABILIZED OSCILLATOR. P. L. Jessen and H. J. Price (to U. S. Atomic Energy Commission). U. S. Patent 2,827,569. Mar. 18, 1958.

This patent relates to sine-wave generators and in particular describes a generator with a novel feedback circuit resulting in improved frequency stability. The generator comprises two triodes having a common cathode circuit connected to oscillate at a frequency and amplitude at which the loop gain of the circuit is unity, and another pair of triodes having a common cathode circuit arranged as a conventional amplifier. A signal is conducted from the oscillator through a frequency selective network to the amplifier and fed back to the oscillator. The unique feature of the feedback circuit is the amplifier operates in the nonlinear portion of its tube characteristics thereby providing a relatively constant feedback voltage to the oscillator irrespective of the amplitude of its input signal.

10281

PULSE AMPLITUDE ANALYZER. M. H. Greenblatt (to U. S. Atomic Energy Commission). U. S. Patent 2,828,425. Mar. 25, 1958.

This patent pertains to pulse amplitude analyzers for sorting and counting a series of pulses, and specifically discloses an analyzer which is simple in construction and presents the pulse height distribution visually on an oscilloscope screen. According to the invention, the pulses are applied to the vertical deflection plates of an oscilloscope and trigger the horizontal sweep. Each pulse starts at the same point on the screen and has a maximum amplitude substantially along the same vertical line. A mask is placed over the screen except for a slot running along the line where the maximum amplitudes of the pulses appear. After the slot has been scanned by a photocell in combination with a slotted rotating disk, the photocell signal is displayed on an auxiliary oscilloscope as vertical deflection along a horizontal time base to portray the pulse amplitude distribution.

PERSONAL AUTHOR INDEX

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